News of the Industry Begins Page 28

JUL 8 1929

AUTOMOTIVE INDUSTRIES

Volume 61
Number 1

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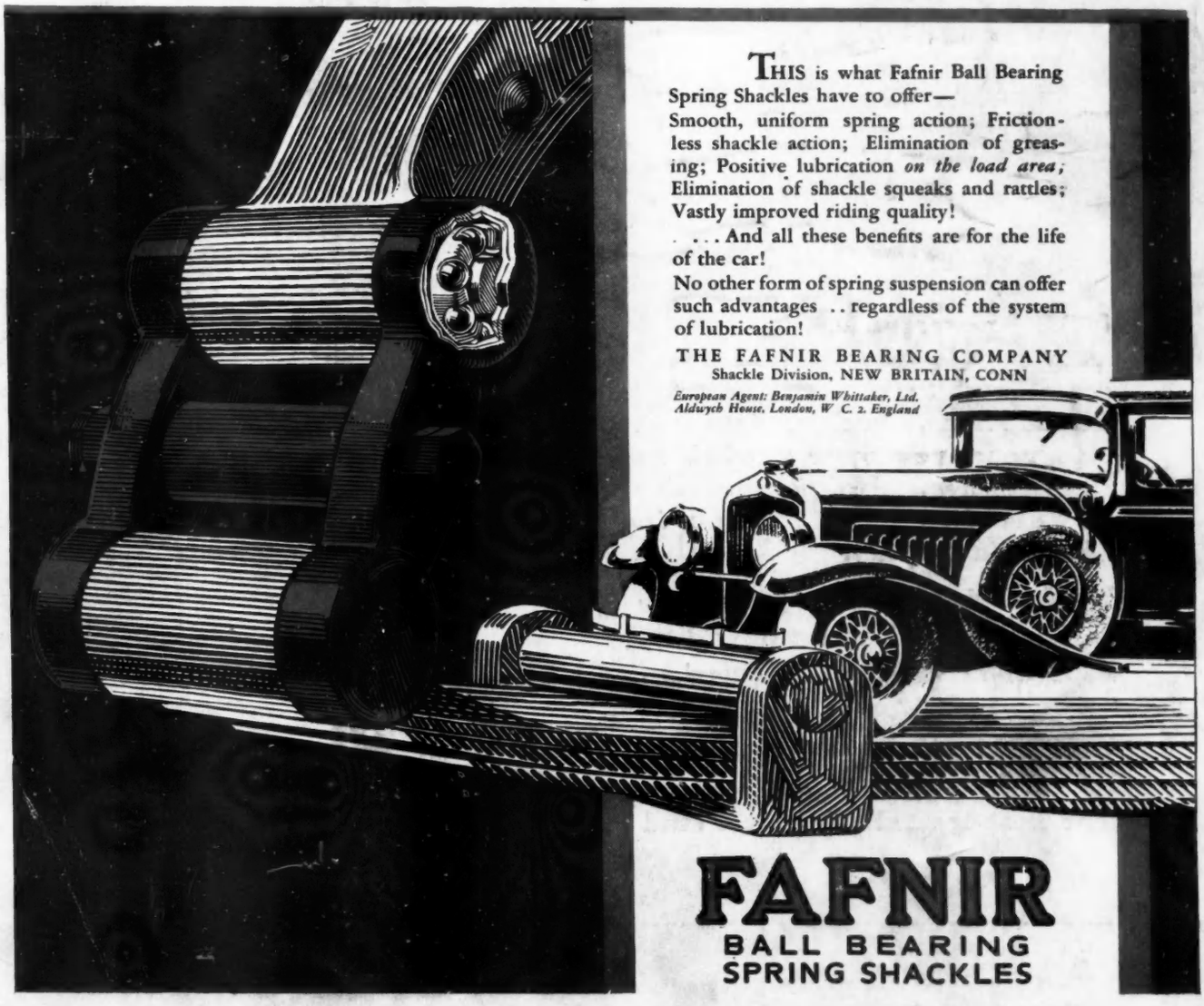

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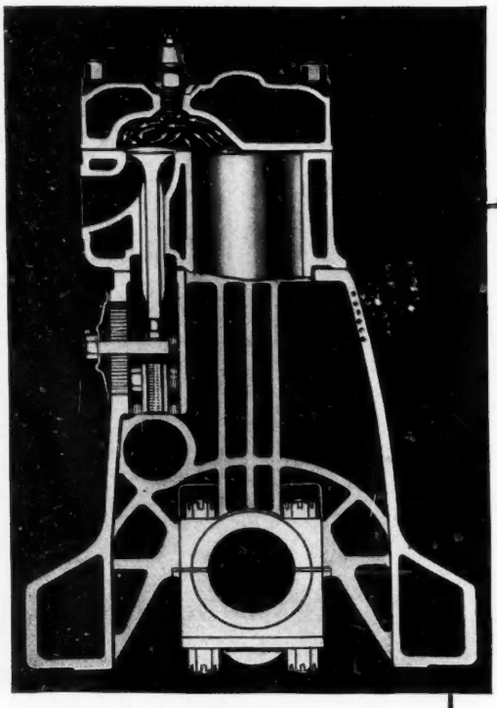

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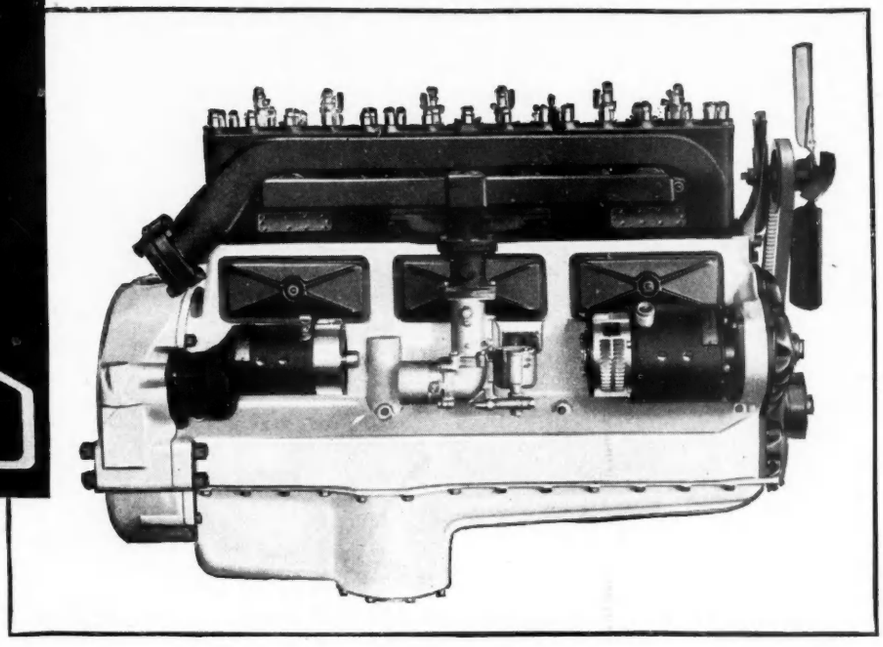

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Bulletin No. 718 describes this engine in full detail. Write *Automotive Equipment Division, Waukesha Motor Company, Waukesha, Wisconsin. Offices: 8 West 40 St., NewYork—7 Front St., San Francisco.*

956

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AUTOMOTIVE INDUSTRIES
The AUTOMOBILE

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Vol. 61 No. 1

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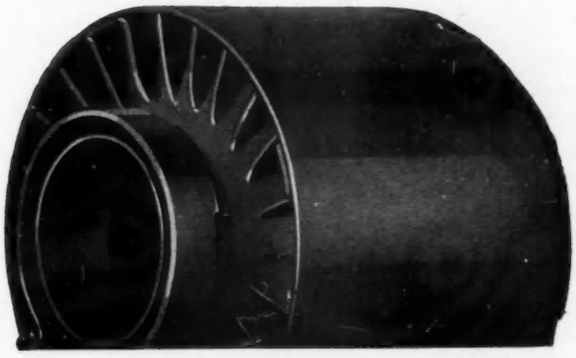
An Important



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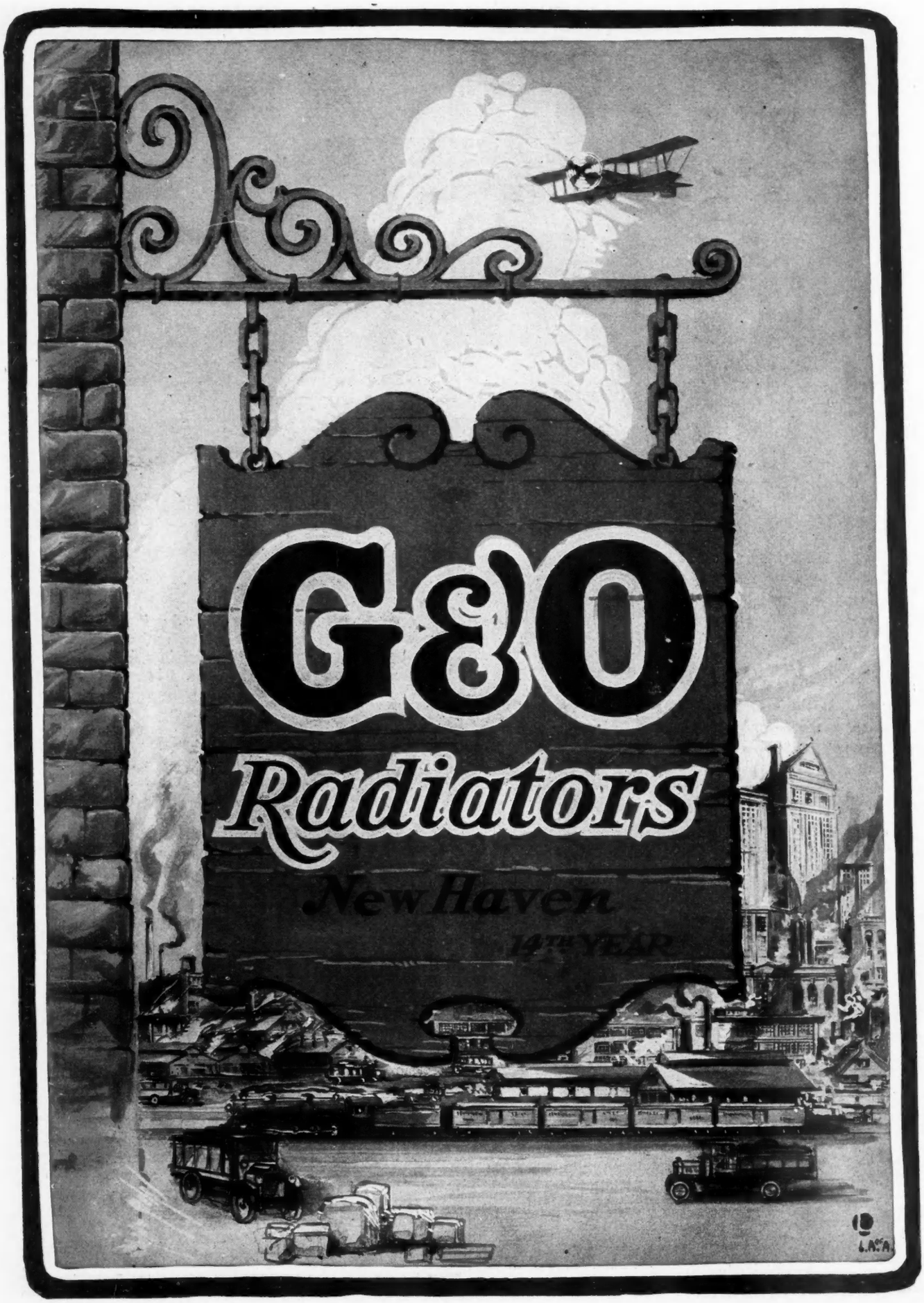
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14TH YEAR

AUTOMOTIVE INDUSTRIES
VOLUME 61 *Philadelphia, Saturday, July 6, 1929* NUMBER 1

Science and Sports Mingle at S. A. E. *Summer Meeting*

Controversy in Combustion Chamber Design Conference proves an attraction. Chassis session evokes interesting data. More than 800 persons attend the convention.

By EARL O. EWAN

Photos by N. Lazarnick

VERSATILITY of the automobile engineer and his immediate associates in the industry that is shattering all records for producing vehicles for pleasure and transportation was again proved last week by the successful carrying through of the varied program at the annual summer meeting of the Society of Automotive Engineers, held this year at Saranac Inn, New York.

More than 800 persons, including 200 women, participated in the meeting, which consisted of activities ranging from highly scientific discussions to a water carnival, a field day and other events in the realm of sports. For those of divers interests and capacities, the meeting schedule left but few free hours in the day and evening, despite the weather, which interfered somewhat on Tuesday, the first day, and on Friday, the last day of the meeting. The rain on those two days, however, gave a basis for a keener appreciation of the exhilarating weather enjoyed on Wednesday and Thursday at that altitude, which is some 1600 ft. above the sea.

Arrivals by automobile, train and hydroplane were almost continuous throughout Tuesday. In the evening, the guests assembled for the first session after a day devoted to renewing acquaintances and participation in the sports events. A business session came first, with W. R. Strickland, president of the society, presiding.

W. R. Strickland, president of the Society of Automotive Engineers, who presided over the Summer Meeting at Saranac Inn, N. Y.

Proposed amendments to the constitution of the society that have been under consideration for several months were introduced, and it was agreed that they should be submitted to a vote by mail. Four additional amendments were proposed by W. H. Conant, of New York City, and were referred to committee by Mr. Strickland.

The first would provide that dues paid the organization should be for 12 months, dating from the first of the month following notice of election to membership. The second would make dues payable semi-annually in advance. The third would specify the administrative year of all sections as from July 1 to June 30. The fourth would permit the society to establish, subject to such by-laws or rules as the Council might prepare, awards or other forms of recognition for papers of particular merit, and authorize the council to accept donations or endowments for that purpose.

Edward P. Warner, former Assistant Secretary of the Navy for Aeronautics and now editor of Aviation, who was nominated for the presidency of the Society of Automotive Engineers. The nomination is tantamount to election

Mr. Conant moved that the president of the society appoint a special committee, consisting of not less than three nor more than eleven members, to prepare revisions of such provisions of the society's constitution as no longer are appropriate to the present size and scope of the organization.

The committee members would be asked to serve for one year from the date of appointment. They would be requested to make a preliminary report at the next

annual meeting and a final report at the following semi-annual meeting. The motion suggested that the views of the society's regular constitution committee on all changes contemplated should be submitted with the report of the special committee.

Closing the business session promptly after referring the motion and the proposed amendments to committee, Mr. Strickland introduced Norman G. Shidle, directing editor of the Chilton Class Journal Company, who presided at the general session, which followed. Mr. Shidle introduced Paul G. Hoffman, vice-president in charge of sales of the Studebaker Corp. of America, as a man whose experience had qualified him eminently to treat his subject, "What I Think Engineers Are Good For—and How."

"In discussing engineers with other sales executives," said Mr. Hoffman, "I have found that the general consensus is that the prime difficulty is the inclination on the part of engineers to take any criticism of their designs as a personal insult. That is natural, like parental love, I suppose, but even that is now recognized as being dangerous unless controlled."

Despite his criticism, the speaker credited automotive engineers with having done the most of any single group in the last thirty years to change the life of the American people and thus to assist their progress. He predicted that in the next twenty years they will be required to perform even more important work than in the past.

The Combustion Session Wednesday morning came the nearest of any session to providing fireworks. There, face to face, W. A. Whatmough, consulting engineer, Automotive Engineering Co., Ltd., Twickenham, England, and R. N. Janeway, a consulting engineer, of Detroit, and Alex Taub, research engineer of the Chevrolet Motor Co., continued their controversy concerning theories and practices of combustion chamber design.

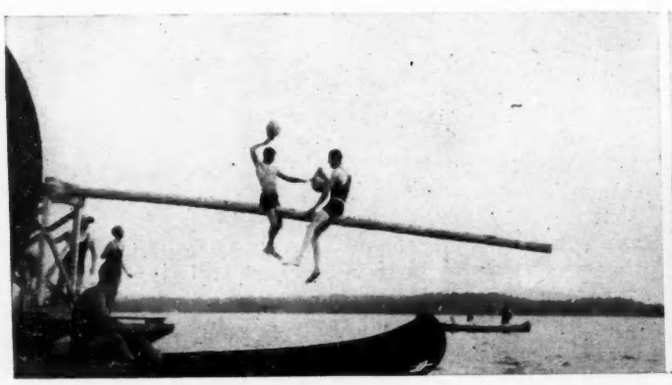
The Motor Truck Design Conference, held the same morning, was devoted largely to a discussion of the relative advisability of using standard trucks with special equipment or special trucks built to meet the specific need. One paper was presented. It was entitled "Extending the Use of Motor Vehicles Beyond the Field of Transportation." It was read by T. C. Smith, of the American Telephone & Telegraph Co.

At the Chassis Conference held Wednesday afternoon, one of the most interesting facts brought out was that under certain conditions the rotary motion of the front axle I-beam actually produces a negative caster angle, and that the instantaneous center of rotation may be anywhere within a 12-in. circle. This was disclosed by William B. Barnes, of the Auburn Automobile Co., who read a report as one of the members of the sub-committee on front wheel alignment research. Progress was reported in the research concerning headlight glare and riding qualities.

The essence of the Transportation Session held Thursday morning was expressed, perhaps, by Nathaniel Mallouf, of the Mallouf Haulage and Maintenance Co., Long Island City, N. Y., in the statement, "Neither the utmost economy nor the great potentialities of the modern motor truck will ever be realized until motor transportation is fully recognized as a separate and distinct business standing on its own feet and guided by a profit-and-loss statement." The statement was contained in his paper on "The Science of Business Applied to Motor Truck Operation." "Recent Developments in Overland Passenger Services," was the title of a paper read by R. E. Plimpton of Chicago, associate editor of *Bus Transportation.*

Several speakers at the Mixture Distribution Conference, held the same morning, emphasized the point that the air horn of the carburetor tends to cause a non-uniform flow up the riser with respect to its axis, which leads to unequal distribution of gas between the front and rear cylinders. Preliminary reports on various research activities being carried on relative to different phases of the

Seen at the outboard motor boat races was Dalton Risley, Jr. (above), who was one of the judges, and Sidney R. Dresser, seen in the close-up of the outboard sled (left), who piloted one of the craft to victory for the Metropolitan Section. At the right is seen an interesting heat in one of the races

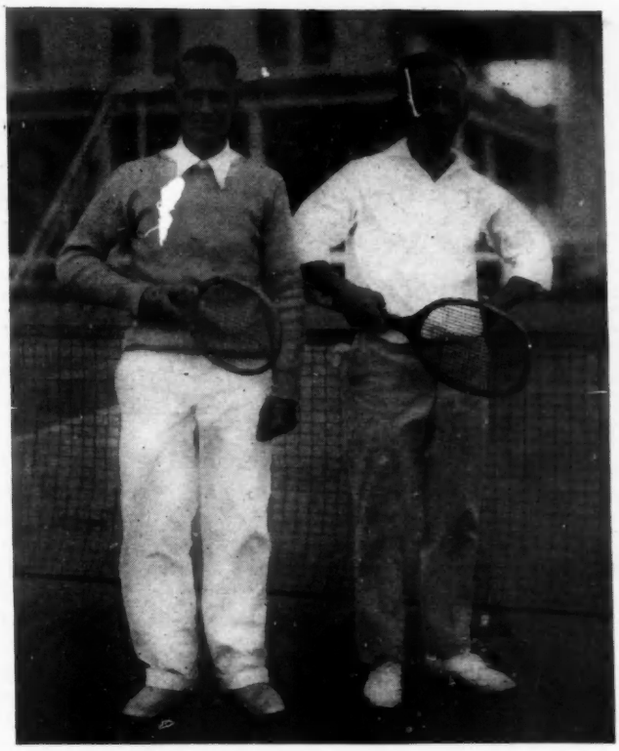


Scenes at the water carnival. Note the greased pole tilting event (left), which was won by Ralph Baggaley, Jr. Clarence Bruce won second place

subject of the conference were made.

At the Airship Session held Thursday evening, the speaker was V. R. Jacobs, assistant manager, aeronautic department, Goodyear Tire & Rubber Co. He was preceded on the program by Alfred F. Masury, of the International Motor Co., who related his experiences as a passenger in the recent unsuccessful attempt of the Graf Zeppelin to cross the Atlantic.

The closing session of the meeting, the Research Session, held Friday morning, was devoted to reports by representatives of the Bureau of Standards on the cooperative fuel research that has been conducted by the department since 1918 with the assistance of the Society of Automotive Engineers, the National Automobile Chamber of Commerce and the National Petroleum Institute.



J. P. Nikonow, at the right, won the tennis singles for men, while B. J. Lemon, at the left, was runner up

A place for the 1930 summer meeting of the society has not been chosen. Edward P. Warner, former Assistant Secretary of the Navy for Aeronautics, was nominated for the presidency of the society Thursday evening. His name was presented following the Airship Session by A. J. Scaife, of Cleveland, chairman of the nominating committee. The nomination is tantamount to election.

Mr. Warner assumed the editorship of *Aviation* on July 1. He is 35 years old, and from 1924 to 1927 was professor of aeronautical engineering at Massachusetts Institute of Technology. He is the holder of the medal of the Aero Club of France, which was awarded for the best technical work on aeronautical engineering for 1927. From 1927 until early this year, he was assistant secretary of the Navy for aviation. Other nominations will not be announced until the result of the vote by mail on the proposed amendments to the constitution has been learned, since they would change the official set-up of the organization if adopted.

Results of the sports events follow:

Golf tournament for men: Championship Flight —I. J. Osbun, first; J. F. Marshall, second. Low net, W. M. Horton. Flight A—C. M. Whelan, first; J. T. Kennedy, second. Flight B—E. Clissold, first; V. H. Harris, second. Flight C —J. H. Smith, first; C. M. Adams, second. Blind Bogey Contest, W. H. Johnson. Least number of putts, J. T. Caldwell. Medal play handicap, John H. Hunt. Consolation prize, Harry Reiser.

On the fairway of the golf links near Saranac Inn, N. Y., during the Summer Meeting of the Society of Automotive Engineers. In the championship flight, I. J. Osbun was first and J. F. Marshall, second. In the golf tournament for women, Mrs. C. H. Foster was first and Mrs. Jack Gray, second

Golf tournament for women: Mrs. C. H. Foster, first; Mrs. Jack Gray, second.

Men's singles in tennis: J. P. Nikonow, first; B. J. Lemon, second.

Men's doubles in tennis: D. S. Cole and Graham Edgar, first; W. F. Rockwell and T. Bourke second.

Women's singles in tennis: Mrs. Graham Edgar, first; Mrs. C. T. Klug, second.

Men's archery: L. E. Lighton, first; J. F. Marshall, second.

Women's archery: Mrs. J. F. Marshall, first; Mrs. J. H. Hunt, second.

Final results of the outboard motorboat race: S. R. Dresser, piloting for the Metropolitan Section, first; C. S. Bruce, piloting for the Washington Section, second; F. C. Nicholson, piloting for the Pennsylvania Section, third, and W. E. England, piloting for the Cleveland Section, fourth. The fastest time for one heat was made by the Red boat when piloted by England for the Cleveland Section in the last race. His time was clocked at 8 min. 55 sec. for the 2¼ miles.

Prize winners in the water carnival were: Twenty-five-yard free style event, C. H. Foster, first, and Raymond Owen, Jr., second. Greased pole tilting, Ralph Baggaley, Jr., first, and Clarence Bruce, second. Nightshirt relay, Denny Duesenberg and Clarence Bruce, first, and J. S. Wardwell and N. F. Rockwell, second. Obstacle relay, Frank Callender, first, and Ruth Callender, second. Canoe race, J. F. Marshall, and Denny Duesenberg, first. Canoe race for women, Ruth Callender, first and Betsie Callender, second.

Prize winners at the field day were: Men. Crab race, Clarence Bruce. One out, F. A. Hurd. Sack relay, team of six, J. S. Wardwell, A. A. Bull, E. O. Jones, Neil McMillan, Bert Brodt, and Leo Wenzel. Prohibition race, Ralph Baggaley, Jr. Four-legged sack race, team of three, Neil McMillan, Olney Jones, and Bert Brodt. Centipede race, team of six, Robert Germane, F. Hurd, Ralph Baggaley, Jr., R. M. Curts, C. S. Bruce and D. Brooks. Marshmallow eating, R. M. Curts. Egg throwing, team of two, Clarence Bruce, and D. Brooks.

Women. Volley ball kicking, Mrs. E. Van Hambach. Hidden kicks, Mrs. G. T. Greenlee. Lemon tossing, Mrs. G. N. Edgar.

Men and women. Match box passing, three men and three women, Robert Gannett, M. A. Smith, W. E.

(Continued on page 12)

Engineering and Sales Departments Advised to *Agree on Objectives*

Only by uniting forces can they turn out mechanically sound and marketable cars, session is told by Paul G. Hoffman, vice-president of the Studebaker Corp.

ACCORD between the engineering and sales departments of automobile manufacturing companies is essential to the production of mechanically sound and marketable cars, Paul G. Hoffman, vice-president in charge of sales of the Studebaker Corp. of America, declared in addressing the opening session on the subject, "What I Think Engineers Are Good For—and How." He was introduced as a man well qualified to discuss the subject because of his experience both as a distributor and as a factory executive, by Norman G. Shidle, directing editor of the Chilton Class Journal Co., who was chairman of the session.

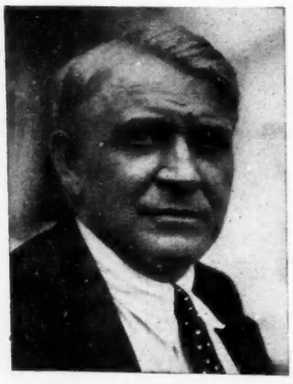
"There may have been a day when engineers could design a car that any sales department could sell," said Mr. Hoffman. "There may have been a day when the sales department could sell anything the engineers might design. But today, both departments must apply their efforts to determine the taste of the whimsical customer.

"If you have a sales department and an engineering department using up their energy fighting each other, the result is zero."

By way of general criticism, Mr. Hoffman pointed out conditions and characteristics that make agreement between the two departments difficult.

"In discussing engineers with other sales executives," continued Mr. Hoffman, "I have found that the general consensus is that the prime difficulty is the inclination on the part of engineers to take any criticism of their designs as a personal insult. That is natural, like parental love, I supose, but even that is now recognized as being dangerous unless controlled.

"Then there is the inclination of too many engineers to think in terms of their specialty instead of the whole car. To use an old simile, 'They can't see the forest for the trees.' If they can't think of the whole car, they can't think of the customer.



One of the pioneers, Frederick S. Duesenberg

"The customer is not interested in the number of crankshaft bearings, but in smooth mechanical performance. He is not interested in a certain type of spring, but in an easy riding car. An engineer must think of the car as a whole and of the customer.

"Then, too, engineers forget sometimes that cars have to be repaired. Numerous service managers with whom I have talked wish that the engineers had to devote one day in each month to getting a 'worm's eye view' of repairing a car they designed with tools included as standard equipment with the car, or with tools available in a country garage."

At the left is Paul G. Hoffman, vice-president in charge of sales of the Studebaker Corp. of America, who spoke at the General Session on "What I Think Engineers Are Good For—and How." He is seen here with John A. C. Warner, assistant research engineer, Studebaker Corp. of America

At Studebaker, practically complete accord has been reached between the engineering and sales departments, Mr. Hoffman said. As a first step in this direction, he explained, the sales executives indexed the qualities in a car that influence its salability. He summarized them as:

1. Character or reliability.
2. Appearance.
3. Performance.
4. Value.
5. Comfort.
6. Economy.
7. Safety.

Contacts that resulted between the two departments after beginning on this basis helped in reaching an agreement, according to Mr. Hoffman.

Despite his fault finding, the speaker credited automotive engineers with having done the most of any single group in the last thirty years to change the life of the people of America and thus assist in their progress. He predicted that in the next twenty years they will be required to perform even more important work than in the past.

At the brief business session which preceded the speech by Mr. Hoffman, proposed amendments to the constitution of the Society of Automotive Engineers that have been under consideration for several months were introduced, and it was agreed that they should be submitted to a vote by mail. Four additional amendments were proposed by W. H. Conant and were referred to committee by W. R. Strickland, president of the Society, who presided during the consideration of business.

Oil Engine Power *Problems* Center Around *Fuel Injection* Methods

Nature and number of papers presented at A. S. M. E. Oil Power Conference at State College, Pa., indicate appreciable progress in high-speed Diesel development.

By EDMUND B. NEIL

THAT interest in oil engine development continues at a high level, and that appreciable progress has been made even within the year since the last oil power meeting, was clearly indicated by the nature and number of papers presented at the second national and third annual Oil Power Conference held at Pennsylvania State College during the week of June 24. Indicative of the problems surrounding oil engine design, the papers presented centered around those incident to fuel injection methods, the design of injection valves and the processes of combustion occurring in engines of this type, particularly engines falling into the "high-speed" class, which have been established arbitrarily as those running at 1000 r.p.m. or over, and which in turn are those of greatest interest to automotive engineers.

Detailed specifications of Diesel type engines available on the market today were presented by Otto Nonnenbruck, chief engineer, De La Vergne Machine Co., and are reproduced in Tables 1, 2 and 3. Representative types of gasoline and Diesel type engines for various services are included. Several designs utilizing precombustion chambers are offered.

In the discussion following this paper R. B. Jackson of the Aluminum Co., presented slides showing that a reduction of 50 per cent in connecting rod weight would result in a 34 per cent reduction in work done by the connecting rod bearing, and also indicated the possible benefits to be derived through the increasing thermal conductivity of aluminum with increase in temperature. J. L. Goldthwaite, who also presented a paper on high-speed oil engine pumps and injection valves, stated that the high-speed oil engine need not be heavier than the gasoline engine for similar types of service, this being somewhat contradictory to prevailing opinion, but which was confirmed by a number of others hearing Mr. Nonnenbruck's paper. Mr. Ernest Nibbs, Electric Bond & Share Co., presented a method of evaluating oil engine performance through the inclusion of such factors as mean pressure, stroke-bore ratio, speed, etc., in a formula.

W. F. Joachim, Westinghouse Electric & Mfg. Co., mentioned that engineers should look forward to possible future development of beryllium in engine construction, of extending the nitriding process and using corrosion resisting steels for spray nozzle parts and injection pumps.

The paper by Mr. Goldthwaite of the Allison Engineering Co., on injection nozzles discussed the single and multiple hole, centrifugal and annular types used by various engine makers and those developed by the National Advisory Committee for Aeronautics at Langley Field, Va.

"That a material change in views concerning the action of the fuel in its passage through the nozzle and in the combustion chamber had taken place recently, may be noted from the fact that it was originally assumed that the fuel must first be atomized by friction with air, then heated, vaporized, and the vapor mixed with air, before combustion takes place. Diesel himself held this view," Mr. Goldthwaite stated.

"Researches by Ricardo and others since the war have changed these views. It is now well established that the fuel drops ignite and burn directly from the liquid state.

"The design of the fuel system is closely bound up with that of the combustion chamber. In an engine designed without great turbulence, the injection valve must both atomize and distribute the fuel. If turbulence is used the design of the valve becomes less important; and finally in the precombustion engine, only moderate atomization is needed; the violent ejection of the partly burned charge from the ante-chamber affects both mixing and combustion. However, as the injection system is improved, the problem of the combustion chamber becomes simpler. With an ideal injector little or no turbulence would be necessary; the ante-chamber would probably disappear, and we could determine the shape of the indicator card by the profile of a cam. The problem then is to produce a sufficiently fine spray and project it where wanted—accurately metered and correctly timed.

"With any given nozzle the size and uniformity of the drops of spray are functions of the jet velocity—that is, of the injection pressure. There is only one way to get fine atomization, and that is by using high pressures, and since the excellence

General Cost Data for High-Speed Diesel Engines

Depreciation	7 to 10 per cent of original cost, annually
Maintenance and repairs	0.05 cent per rated b.hp.-hr.
Taxes and insurance	2 per cent annually
Interest	5 to 7 per cent annually
Fuel per b.hp.-hr.	0.42 to 0.6 lb.*
Lubricating oil	0.0005 gal. per hp.-hr.

* Depending upon various factors, such as percentage of time under full load.

From a paper by Chester A. Gibbons

of combustion is a function of atomization, the engine efficiency should increase with the injection pressure. This has been demonstrated at least up to 4000 lb. pressure, although it would probably not apply in a precombustion engine.

Single-Hole Type Limited

"The single hole nozzle sometimes used in precombustion engines requires strong penetration which can be obtained readily at comparatively low pressure (1400 lb.) with a rather large orifice. This nozzle is not adapted so readily to other engines since it is difficult to distribute the fuel. A slight accidental rounding of the entering edge may also affect the discharge rate. When several small holes are used, the size when applied to small engines becomes so small that they are extremely difficult to drill and are easily damaged or clogged.

"The centrifugal nozzle with its spiral guiding passages which projects the oil in a fine conical spray definitely improves atomization and is more effective in creating turbulence. While in all respects it may not be equal to the multiple hole nozzle, it is free from small holes, and the characteristics of a given nozzle can readily be changed by substituting a different spiral core or rod.

"The annular orifice obtained by inserting a plug in a larger hole or by using a poppet valve with a very small opening produces a conical spray with an 'edge effect' greater than with other designs and the pressure energy is utilized to the fullest extent at the same time, presenting a larger spray cloud area to the air. With the plug type extreme precision is necessary in the centering of the plug, which is perhaps the reason why this type is not much used.

"A more attractive type is the conical or flat seated valve. The original McKechnie valve, probably the first successful high speed injector, had a flat seat with very thin edges, producing a spray in the form of a thin flat disk. It is obviously a difficult nozzle to make and to maintain. A conical valve, however, has the advantage of being in some degree self-centering. The self-centering feature is not to be trusted in the design of the valve, but if the necessary precision is built into it, this nozzle is more likely to maintain its accuracy than either of the other types.

"The spray formation deserves special attention. The valve projects a thin sheet in the shape of a conical surface of which the valve is the apex. As the diameter increases the thickness of the sheet necessarily diminishes, until a point is reached at which the sheet can no longer maintain continuity, and it literally bursts into spray. For example, if a valve ½ in. diameter opens .001 in. the thickness of the sheet at 3 in. diameter will be .00017 in. or .004 millimeters—about the same as the diameter of the drops produced by air injection with a blast pressure of 1100 lb.

"At any given opening and pressure the sheet will break into spray at a definite distance from the nozzle, hence, we can project the sheet into a definite part of the combustion chamber and there convert it into spray. Both surfaces of the sheet presenting a large area to the air, and moving at terrific velocity (9000 ft. per second at 5000 lb. oil pressure), will set up a powerful air turbulence moving toward the spray. If the valve is heavily spring loaded, its opening will vary with different fuel pressures, and the spray will be formed at varying distances from the valve, so that during the rise and fall of oil pressure during the injection cycle some part of the spray will be produced in every part of the combustion chamber.

N.A.C.A. Injection Valve

"A very interesting development of this type is seen in the N.A.C.A. injection valve No. 9. In this injector the valve opens by flexing of the thin lips of the valve and seat. The valve is accurately centered by the stem, which is fluted near the lower end and lapped to a snug fit in the sleeve. The stem does not move, but the opening pressure is set by tension, adjusted by a nut at the upper end. There is practically no inertia to oppose opening or closing.

"Any of the foregoing types can be of the open—or closed type. The open type is always open to the cylinder, and the oil flow is controlled entirely by the pump. A light check valve may be used to prevent the cylinder air pressure from penetrating into the fuel lines. The closed type has a spring loaded valve or its equivalent which is opened either by a cam or by the pressure of the fuel.

"The open nozzle of course is much simpler, as it has no moving parts. It has another decided advantage, that any air that finds its way into the pump will pass out freely through the nozzle, whereas a tiny bubble, in a closed system under high pressure, will lock the entire system. But it has a very grave objection. Since oil pressure cannot be built up or relieved instantly, the start and the finish of every injection must necessarily take place at low pressure, and those portions of the spray will be coarse. The

TABLE 1

Successful Engine Types Suitable for Various Purposes

	MAKER	Cylinder and Type	Bore and Stroke Inches	Piston Displ. Cu. In.	R. P. M.	Piston Speed Ft. p. M.	M. E. P.	H. P.	Weight Complete	Wt. per H. P.	Wt. per Cu. In.
1	DE LA VERGNE Permanent Stationary Type	6 Diesel	17 x 24	32600	225	900	65	600	145000	242	4.45
2	ATLAS IMPERIAL Heavy Duty Marine	6 Diesel	8½ x 12	4070	325	650	75	125	17500	140	4.30
3	WAUKESHA Heavy Duty Industrial	6 Gasoline	7¾ x 8½	2410	1000	1415	91	275	7340	26.6	3.10
4	WINTON Pleasure Boat	6 Diesel	8 x 10	3000	700	1170	75	200	8000	40.0	2.67
5	BUDA Truck and Bus	6 Gasoline	4 x 5⅛	387	2000	1700	75	73	946	13.0	2.45
6	CONTINENTAL Passenger Car	6 Gasoline	3⅜ x 4	215	2900	1930	78	61	468	7.69	2.18
7	BEARDMORE Locomotive	6 Diesel	8¼ x 12	3850	750	1500	83	300	4000	13.3	1.04
8	CURTISS Airplane	12 Gasoline	5⅛ x 6¼	1549	2400	2500	128	600	755	1.25	.49

TABLE 2

Specifications of Commercial High-Speed Diesel Type Engines

	MAKER	Cylinder	Bore and Stroke Inches	Piston Displ. Cu. In.	R. P. M.	Piston Speed Ft. p. M.	M. E. P.	H. P.	Weight Complete	Weight H. P.	Weight Cu. In.
1	BUDA	4	6 x 8	900	1000	1330	80	92	3100	33	3.45
2	M. A. N.	4	4.7 x 7.1	500	1000	1180	72	45	1500	33	3.3
3	M. A. N.	6	4.7 x 7.1	745	1000	1180	72	68	1950	29	2.6
4	M. A. N.	4	6.5 x 8.7	1150	1000	1450	76	110	3500	32	3.04
5	M. A. N.	6	6.5 x 8.7	1720	1000	1450	76	165	4500	27	2.6
6	LINKE-HOFMANN	4	4.5 x 6.5	410	1200	1300	80	50	1100	22	2.7
7	DEUTZ	4	4.5 x 6.7	432	1000	1115	74	40	1300	32.6	3.0
8	DEUTZ	6	4.5 x 6.7	650	1000	1115	74	60	1600	27.0	2.5
9	KOERTING	6	5.1 x 7.1	880	1200	1420	67.5	90	3300	36	3.75
10	BENZ	6	4.1 x 6.5	520	1300	1400	83	70	1600	23	3.10
11	MAYBACH	6	5.5 x 7.1	1020	1300	1535	90	150	2650	17.7	2.6
12	JUNKERS	2	3.15 x 11.8	183	1000	983	86	40	640	16.0	3.5

same thing happens at low speeds, when the pump plunger is moving too slow to build up high pressure against the constant outlet area. Of course at low speeds the atomization need not be so fine: it may even be desirable to delay ignition by such means.

"The closed nozzle, on the other hand, can be set by spring tension, or otherwise, to a definite opening pressure. It remains closed until this pressure is attained, and closes promptly when the pressure falls. Consequently all the spray is injected at high pressure regardless of speed or pump characteristics. Against this must be set the possibility of leakage, especially if fairly high pressure is maintained in the injection pipe between injection periods; a leak may have very serious results in the engine. If a closed valve is not very nearly perfect, it will be a total failure.

"The valve seats of closed nozzles require careful study. The seats must be narrow, so that seat pressure will be high; but they will chip if too narrow. One company that has standardized on valve units makes seat .020 in. wide. From the standpoint of unit pressure, the N.A.C.A. recommends 15,000 lb. per sq. in. seat pressure. Both seats should be the same width, otherwise wear will develop a step on the wider seat.

"Valve stems must be very accurately guided. We can not expect the valve to center itself in a half-thousandth of a second. Very closely lapped stems and bores must be used.

"Packing of any sort is utterly impractical. The friction of any packing tight enough to hold high pressure will make a valve erratic, but a stem lapped to a very accurate fit in a smooth lapped bore will hold any pressure. The length of the fit should be 8 to 10 times the bore.

"If the entrance to the orifice is rounded, it will be less likely to change from slight abrasion, as from dirt in the oil.

Heat Effects On Valve

"A high grade tool steel, or hardened stainless steel, should be used for valve seats.

"The effect of heat on the injection valve is much less than usually supposed, for while the valve is heated from the outside it is always cooled by the flow of oil within. Consequently, valves have a tendency to run cooler at full load."

With reference to the operation of fuel pumps Mr. Goldthwaite brought out the importance of the fact that in contrast with lay opinion, "oil, like other liquids, is compressible: the modulus is of the order of .0001 per atmosphere pressure. At 6000 lb. it compresses about 4 per cent. If our system holds one cubic inch of oil, the compression will be more than three times the amount of the charge for say a 6 in. x 7 in. cylinder. (Fuel pipes are only slightly elastic, less so than generally supposed; for, if we work a steel tube at a fiber stress of 30,000 lb., or a brass tube at 12,000 lb., it will increase only 0.1 per cent in diameter, or 0.2 per cent in cross-section area, which is negligible.) Imagine that our system is injecting air at 0.6 lb. gage pressure (4 per cent above atmospheric) instead of oil at 6000 lb., and we have a very clear picture of the process.

Control of Cam Clearances

"This condition is at its worst when we use an open nozzle at the end of a long pipe; the gradual rise and fall of pressure at the beginning and end of the injection period can readily be visualized from the compressed air analogy, and the necessity for high plunger speed and for generous quick opening overflow valves is at once apparent.

"On the other hand this elastic complication disappears entirely in the so-called 'common rail' system having the nozzles operated directly by a cam. Such an arrangement is generally considered undesirable, because the long camshaft introduces mechanical complications: it is hard to control cam clearances when the entire engine structure distorts with heat.

"The commonest arrangement is a set of plungers, each discharging through a pipe to an automatic spring loaded injector. Since the nozzle remains open only at high pressure, the gradual rise and fall of fuel pressure does not affect the atomization; opening and closing are sharp—just as sharp as the inertia of the valve ports permits. But the timing may be seriously affected. The oil in the pipe must be compressed before sufficient pressure is developed; the lag due to this cause is a perfectly definite number of degrees and depends on fixed conditions. Then there are waves which are not so definite, but which affect both opening and closing.

"A compression wave of considerable violence is started through the pipe at the moment pump discharge begins; and it is likely that another wave, started back when the injector closes suddenly, is reflected through the length of the pipe and causes the valve to bounce open again. Photographs by the N.A.C.A. show this secondary discharge. In their study of the phenomena, the lag of opening was decreased by using a high initial pressure in the pipe, and the secondary discharge was eliminated by changing the length of the pipe.

"All these complications are eliminated by combining the plunger with an automatic injector in a single unit on the cylinder head. This is done in the Dorner engine.

"With cut-off by overflow or by-pass; it would be difficult to maintain a predetermined high pressure in the pipes of the usual system. But we can use the constant pressure system, group the admission valves together for convenience, and pipe them to heavily loaded automatic injectors. All factors are thus under control. Say we use 6000 lb. injection pressure and set the injectors to close at 4000 lb. when the injector closes, oil is left at the latter pressure in the line. When the admission valve opens it is then not necessary to compress the oil much farther before injection can start. No great pressure change is involved at either end of the injection cycle, and so there is nothing to set up violent, erratic wave impulses. The entire drive, admission valves and complete controls are all in one compact unit."

Discuss Valve Leakage

In commenting on Mr. Goldthwaite's paper, D. O. Barrett, chief engineer, Superior Engine Co., mentioned that valve leakage was most serious when starting at low speeds. C. R. Alden of the Ex-Cell-O Tool & Mfg. Co., stated that leakage was not of great importance except when a poor oil was used. Valve parts, when fitted to minimum clearance, were found to operate satisfactorily after six months' use when non-rusting steel, immune to the action of water, were used. In comparing injection pump leakage with light and heavy oils, Edgar J. Kates found that light oil gave good combustion even though the leakage was greater, since the higher pressures were not required. From the standpoint of the kind of oil used, W. H. Butler, Standard Oil Co. of New Jersey, emphasized the fact that oil gravity was of far less importance than viscosity, since the latter determined its surface tension.

Mr. Joachim in answer to the hypothetical question, "What is the pressure drop through the valve and what the resultant pressure at the nozzle tip?" propounded by C. H. Martin of the National Advisory Committee of Aeronautics, said that this was not known except by calculation, but he had noted in his experiments that the diameter of the jet appeared to be greater after it had passed through the nozzle than the diameter of the nozzle itself.

In his paper on the "Commercial Application of High-Speed Oil Engines," Chester H. Gibbons, of the Marion Steam Shovel Co., gave details showing the wide variety of uses to which oil engines are now being put. Commercially successful applications for aircraft, tractors, locomotives, trucks, oil field and other services and the sizes and types most suitable for them were mentioned.

Edgar Kates, in his paper on modern refinements in Diesel powerplants, indicated that the same problems in muffling (both intake and exhaust), cleaning of intake air, providing clean lubricating oil, engine balancing which in the past have occupied the attention of automotive engineers promise to have the same position of importance in Diesel development in the near future.

In addition to the foregoing papers a progress report on the oil spray research work of Pennsylvania State College was presented by Kalman J. DeJuhasz, a plea for broadened instruction in oil engine design and theory in the various schools and universities was given by Roswell H. Ward, and a report from the engine operating costs committee was read by Franz Eder, engineer, Robert W. Hunt Co. Problems in the maintenance and repair of marine Diesel engines were discussed by Louis R. Ford.

Standards for Diesel Oils

The A.S.M.E. Special Research Committee in its progress report suggested the following standard specifications for Diesel fuel oils:

	Heavy Duty Engines	Light High-Speed Engines
Viscosity at 100 deg. F. (Saybolt Univ.)	Max. 200 sec.	Min. 45 sec. Max. 10
Sulphur	Max. 3% by wt.	Max. 2%
Conradson	Max. 5%	Max. 1%
Ash	Max. .08%	Max. .02%
Flash	Min. 150 deg. F.	Min. 150 deg. F.
Moisture and sediment	Max. 1%	Max. 0.5%

Note: Specific Gravity or (API)—Gravity is of no importance as pertains to the burning qualities of an oil. It should be given, however, by the supplier in order that weight per gal. can be computed.

A strong plea was made by the oil specifications committee for cooperation between engine builders and fuel suppliers as well as users in testing oils made to the specifications. It was stated that oil would soon be made available according to them, and samples could be secured from companies represented on the research committee.

TABLE 3

Dimensional Specifications of High-Speed Diesel Type Engines

	Buda	M. A. N.	M. A. N.	M. A. N.	M. A. N.	Linke-Hofmann	Deutz	Deutz	Koerting	Benz	Maybach	Junkers
Bore	6	4.7	4.7	6.5	6.5	4.5	4.5	4.5	5.1	4.1	5.5	3.15
Stroke	8	7.1	7.1	8.7	8.7	6.5	6.7	6.7	7.1	6.5	7.1	5.9
No. Cyl	4	4	6	4	6	4	4	6	6	6	6	2
R. P. M.	1000	1000	1000	1000	1000	1200	1000	1000	1200	1300	1300	1000
H. P.	92	45	68	110	165	50	40	60	90	70	150	40
Stroke: Bore	1.33	1.5	1.5	1.33	1.33	1.45	1.48	1.48	1.38	1.57	1.38	1.88
Piston Speed	1330	1180	1180	1450	1450	1300	1115	1115	1420	1410	1535	980
Cyl.—Center: Bore	1.5	.....	.....	1.5	1.5	.....	1.55	1.55	1.7	.....	1.2	3
No. of Main Bearings	5	5	7	5	7	3	5	7	7	7	7	3
Shaft Diam.: Bore	.604	.6	.6	.....	.....	.52	.65	.65	.55	.....	.5	.....
Location of Main Bearings	hung	hung	hung	hung	hung	hung	hung	hung	hung	.....	hung	hung
Conn. Rod—Length: Stroke	2.02	2.25	2.25	.....	.....	2	2	2	2	.....	1.85	.....
Piston: Wristpin Diam.: Bore	.438	.36	.....	.....	.....	.3	.33	.33	.42	.286	.....	.44
Piston: Wristpin—Bearing	float	.....	.....	.....	.....	float	.....	.....	float	.....	.....	.....
Piston: Length: Bore	1.38	1.5	1.5	.....	.....	1.2	1.3	1.3	1.6	1.3	1.3	1.9
Piston: Material	CI	CI	CI	AI	AI	CI	CI	CI	CI	CI	CI	AI
Cyl.: No. cast in one piece	4	2	2	4	6	4	2	2	6	6	6	2
Cyl.: Integ. with Crankcase	Yes	No	No	Yes	Yes	No	No	No	Yes	No	No	Yes
Cyl.: Material	CI	CI	CI	CI	CI	CI	CI	CI	.....	Al	CI	Al
Cyl.: Liners	Yes	No	No	Yes	Yes	No	No	No	Yes	Yes	No	Yes
Material of Liners	CI	.....	.....	CI	CI	.....	.....	.....	CI	CI	.....	CI
Material Crankcase	CI	.....	.....	CI	CI	CI	Al	Al	Al	Al	.....	Al
Heads: Integ. with Cylinder	No	No	No	No	No	No	No	No	No	No	Yes	No
Heads: No. cast in one piece	2	2	2	2	2	2	2	2	1	1	6	.....
Heads: No. of Valves per cyl.	2	2	2	2	2	2	2	2	2	2	2	No
Lubrication Sump	Dry	Wet	Wet	Wet	Wet	Wet	Wet	Wet	Dry	Wet	Wet	Wet
Fuel injection	Dir.	Dir.	Dir.	Dir.	Dir.	Dir.	Prec.	Prec.	Prec.	Prec.	Air	Dir.
Weight per cu. in.	3.45	3.3	2.6	3.0	2.6	2.7	3.0	2.5	3.75	3.1	2.6	3.5

Design of Combustion *Chamber* Becomes *Controversial* Subject

Objections to the methods advocated by W. A. Whatmough, of England, are expressed by R. N. Janeway, Consulting Engineer, and Alex Taub, of Chevrolet.

By P. M. HELDT

RECRIMINATION in the form of written discussion lent somewhat of verbal reality to the "Combustion Session." It was read by R. N. Janeway, a consulting engineer, of Detroit, and Alex Taub, research engineer of the Chevrolet Motor Co. Each discussed the paper on "Combustion Chamber Design in Theory and Practice," written by W. A. Whatmough, consulting engineer, Automotive Engineering Co., Ltd., Twickenham, England, Mr. Whatmough spoke extemporaneously, however, and did not follow the text of his paper. W. T. Fishleigh presided at the session.

"To my mind," read Mr. Janeway, "the outstanding feature of Mr. Whatmough's paper is proof of the astounding backwardness of the art of combustion chamber design as currently practiced by engine designers in England. This is all the more surprising when it is considered that English scientific workers, such as Clerk, Dixon, and Hopkinson pioneered in the study of engine combustion.

"From the illustrations given in Mr. Whatmough's paper," Mr. Janeway read later, "I can see how this condition may occur in actual engines, but if it were not for these illustrations I would have difficulty in believing that anyone could so design an engine and still be allowed to practice his nefarious trade. Certainly, I know of no such horrible example in American engine design even at its worst.

"Mr. Whatmough has presented no research data in support of his contentions," read Mr. Janeway in conclusion, "but merely the net results of wholesale changes in design. It is in the interpretation of such results that the investigator is misled into false theories that bar the way to progress.

"Mr. Whatmough is to be congratulated upon his obvious decision to write this paper in a language fairly common to all of us," read Mr. Taub. "Heretofore his writings have been found difficult due to his remarkable ability to play with words."

A few months ago, two articles on combustion chamber design by Mr. Janeway appeared in *Automotive Industries.* Mr. Whatmough in a letter to *The Automobile Engineer,* an English publication, made the charge that many of the ideas contained in those articles had been borrowed from his writings. This was denied by Mr. Janeway and the controversy between the two was continued at this session.

Mr. Whatmough held in his talk that the valve cavity in an L-head engine is a heat trap which is largely responsible for detonation. He showed two superposed pressure curves from internal combustion engines, one representing a normal pressure rise and the other a smoothed pressure rise. What led to this change in results was a removal of the spark plug from approximately the center of the head to a point in the side wall of the valve cavity remote from the cylinder. There are three distinct differences in the result.

1. Reduction of initial lag in pressure rise, ow-

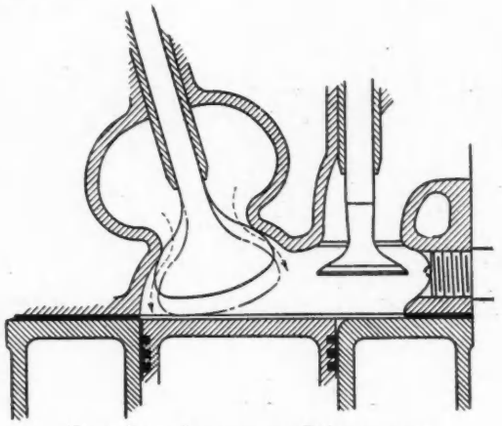
Protagonists at the Combustion Session are shown herewith. They are, from left to right: W. A. Whatmough, of England; R. N. Janeway, Alex Taub, Capt. W. C. Thee and W. T. Fishleigh

ing to an increase in flame speed due to the charge being heated by the hot exhaust valve head.

2. Lowering of peak pressure because the flame is continuously progressing toward the cooler zones.

3. Spreading of higher pressures over a wider working range consequent upon delayed burning.

Power and fuel consumption curves were shown of two cylinders with exactly the same compression ratio but having heads of cast iron and aluminum respectively. With the aluminum head, the engine gave less power and consumed more fuel per horsepower-hour, and the tester reported adversely on it. It was observed that with the cast iron head the engine required a practically constant spark advance between 800 and 1800 r.p.m., which especially adapted it for fixed ignition. Mr. Whatmough's explanation of this phenomenon was that the rise in the temperature of the cast iron cylinder head with the increase in speed resulted in such an acceleration in the rate of flame propagation as to eliminate the need for increased spark advance. The cast iron head, however, could not be used for town ignition, as with it the engine knocked under load at all speeds.



Drawing of a super-efficiency combustion chamber head, discussed in a paper by W. A. Whatmough at the Combustion Session of the S.A.E.

It was also pointed out that the hot exhaust valve, which is generally supposed to be a detriment, is actually an advantage from one point of view, as sleeve valve engines, which do not possess such a valve, show an excessive fuel consumption during the warming-up period and when running light.

Turbulence is the theoretical explanation for increases in flame speed by more or less violent agitation of the combustible during the compression stroke. In practice, an L-head engine with turbulence-type head permits of an increase in compression ratio which leads to an increase in power. The speeding up of inflammation attributed to turbulence is undoubtedly due to the turbulent heating or eddying contact of the unburnt charge with heating surfaces.

The spark advance producing maximum power or incipient detonation can be defined as the critical spark advance and is a measure of the highest permissible flame speed. One of the features of the Whatmough head is a stream-lined or anti-turbulent combustion chamber, which was developed in the first place to prevent turbulent heating of the exhaust valve. As an additional precaution against engine knock, the hottest part of the mixture (that over the exhaust valve) is fired first. This combination of a stream-lined combustion chamber and firing of the charge at a point near the exhaust valve is said to produce smoother and more complete combustion, while better filling of the cylinder results in greater engine power and higher engine efficiency.

Mr. Whatmough gave numerous examples of how he had improved the design of engines by applying these principles, his examples covering both low-speed and high-speed engines. Something was said also with regard to the valve-in-head engine. In England, owing to the fact that the tax is based upon the cylinder bore, it is necessary to get the most power from a cylinder of given bore, and this led manufacturers to adopt overhead valve engines with valve operation by side rods, as these give a higher output per unit of displacement than the less costly side valve engines. However, more recently the more quiet side valve engines have regained ground. The purchaser of speed automobiles in Europe is beginning to object to rough running and frequent reconditioning of sport car engines. Hence, the trend of newer developments in Europe follows the lead of American designers, the tendency being to increase the bore and the number of cylinders of speed cars to obtain flexibility in high gear.

What are referred to as Whatmough principles of heating, flow and cooling effects were summarized by the author as follows:

Heating Effects

1. Heat in air intake is automatically proportioned to fuel metered. This is essential for flexibility and flash acceleration.
2. Available heat in air is arranged in accordance with mean fuel-volatility to produce a saturated or stable mixture. This is essential for volumetric efficiency and fuel efficiency.
3. Warming of wet charge over exhaust valve produces a dry mixture for ignition. It lessens initial lag and uneven running on light load.
4. Warming of clearance space to stop flame quenching and fuel waste.

Flow Effects

5. Streamlining of intake increases effective portway during induction. It gives greater power-output with smaller valves and valve lifts.
6. Streamlining of transfer passage increases flow into cylinder. It removes internal restriction on volumetric efficiency and prevents side thrust of flame on piston.
7. Streamlining the exhaust passages increases useful compression-ratio by minimizing turbulent heating.
8. Directional firing smooths burning. It also burns combustible most likely to ignite spontaneously before dangerous pressure-rise leading to auto-ignition and engine knock.

Cooling Effects

9. Lateral location of exhaust-valve cavity to give extra cooling surface. This prevents auto-ignition in this heat trap and permits the use of a higher compression-ratio.
10. Differential cooling, to counteract zonal effects tending to auto-ignition and flame quenching respectively.

The drawing herewith, reproduced from Mr. Whatmough's paper, was referred to as a futurist design of combustion head. It requires mixture control and compensatory circulation of water as essential preliminaries to its application. A relatively large gallery induction pipe is used, which acts as a reservoir of a stabilized fuel-air mixture. This expansion chamber damps out fluctuations and reversals during engine suction and thereby increases the pumping capacity of the engine. The inlet port takes the form of a curved venturiform annulus as the inlet valve opens, which type of aperture gives a great-

er flow and also lessens the effect of varying suction during sudden opening and closing of the valve. The real object of the curvature of the intake into the cylinder head is to divert the gas flow into the cylinder, as shown by the arrows. An ordinary poppet form inlet valve causes violent eddying at high speeds, owing to the mixture being directed onto the cylinder walls. Flow measurements show that a gallery pipe with a venturiform valve port increases the orifice coefficient by about 40 per cent, but the all-important consideration is that the new type of intake permits excellent volumetric efficiency with a smaller valve lift. This feature is an aid to reduction of valve noise. The cylinder head is of the anti-turbulent type, with lateral ignition.

Differential Water Cooling

Differential water cooling is also embodied in the design, to insure smooth combustion and fuel efficiency. The water circulation in the combustion chamber head is divided into two parts, with separate, thermostatically-controlled outlets. The cooling water enters on the exhaust side and passes around the exhaust-valve seat and spark-plug boss. Recirculation by the pump in the engine occurs until the thermostat opens at 158 deg. Fahr., when the hot water passes to the radiator. On the inlet side, the water stagnates until the thermostat in the separate water header opens at 185 deg. Fahr., when hot water from the exhaust side passes thereto via the cylinder jacket and large ports on the hot side of the cylinder head.

The aim in this cylinder head design is to cool the heated exhaust-valve cavity in proportion to engine speed, and to independently heat the inlet system with relatively stagnant water. The final result is a virtual separation of the inlet and exhaust sides of the head, as in the simplest early form of combustion chamber, the T-head. The difference is that all parts are arranged to the best advantage. The intake is now warmed and mixture flows directly into the cylinder. The exhaust valve cavity consists of a compact combustion chamber arranged laterally to limit intensive cooling to this part.

Mr. Taub referred to the work that has been done on combustion chamber design by Ricardo, Whatmough and Janeway, and said there is a remarkable similarity in the Whatmough and Janeway final results even though their theories differ widely. Both recommend firing from hot into cold, Chevrolet has fired from the exhaust valve for anti-detonation since 1923, as have many others. Both use the clearance space. At least, it is a part of their general design. Both indicate chambers that are relatively non-compact, and have diminishing volume as the burn progresses.

Whatmough and Janeway both recommend avoiding restricting the throat between the valve pocket and the cylinder bore. Chevrolet's practice has been to make its area from one and one-half to twice the effective valve opening area. Whatmouth adds a streamline around both valves for better filling and for reducing the heating of the exhaust valve. Undoubtedly these are valuable aids to high-speed engine operation, although their value is doubtful where large, restricted-range engines are being used.

Mr. Taub said he believed that the mechanical friction between the sleeves, pistons and cylinder walls in a Knight sleeve valve engine, which is large when the engine is cold and the oil therefore quite viscous, accounted for the low fuel efficiency of this engine when starting and idling, and it was not necessary to account for it by the absence of the exhaust valve.

The speaker said he agreed perfectly with Mr. Whatmough as to the necessity of perfect distribution for best results from an engine. He gave an interesting sidelight on the relation between distribution and detonation. During test work on the desert roads of Arizona last August, with atmospheric temperatures of between 116 and 120 deg. Fahr., a set-up was used which included an engine with very good distribution. At full load, the engine consumed 0.54 lb. p. hp.-hr. The carburetor was set accordingly, but the setting proved impractical from a detonating and general cooling standpoint. The setting was then changed to normal (0.70 lb. p. brake hp.-hr.), which eliminated trouble from both detonation and general cooling.

The over-all economy on the road was not affected, since full power economy has no effect on road work. In trips of 3000 miles, the total fuel consumption was practically the same with both carburetor settings. In part-throttle operation, proper fuel distribution is most important from the standpoint of fuel economy, while in wide-open-throttle work it is most important from the standpoint of uniformity, and the richest mixture consistent with common sense should be used.

In concluding his remarks, Mr. Taub said that if Mr. Whatmough had a definite procedure for proportioning combustion chambers he would like to hear it explained.

Commenting on Mr. Whatmough's practice with regard to combustion chamber design, as outlined in his paper, Mr. Janeway said: "His location of the plug over the exhaust valve and at the extreme end of the chamber is decidedly to be preferred to the current American practice of favoring the inlet valve and leaning toward the center of volume of the chamber. In the combustion-chamber contour itself, Mr. Whatmough's typical designs are very closely the same as the so-called modified Ricardo type, which is practically standard practice in this country today. The considerably higher level of compression which Mr. Whatmough claims for his designs over that of very similar designs in this country, must be due in great measure, in general, to higher quality of British fuel and generally smaller cylinder size of the British engines. For these reasons, the American 5¼ to 1 compression ratio is probably equivalent on an average to the 6 to 1 permissible in English practice."

Flame-quenching Criticised

Mr. Janeway did not accept the flame-quenching theory advanced by Mr. Whatmough, in regard to which he said: "He furthermore subscribes to the fallacious idea originally advanced by Ricardo that the flame is quenched due to the high cooling effect of the clearance space and, therefore, that the gas in this space does not burn completely. Ricardo added that for this reason also the gas cannot detonate. If the quenching hypothesis were correct, this would, of course, be true; but the fact is that this gas not only will burn normally but will also detonate."

Some work done at Massachusetts Institute of Technology on spectrum chemical analysis of motor fuel combustion was outlined in a paper by Capt. Walter C. Thee, U.S.A. The greater part of the paper was given over to a general explanation of spectra and their production. In the work at the Massachusetts Institute, reference spectra of iron and lead and a spark-plug electrode spark spectrum were produced simultaneously with the fuel spectrum, a Marconi ¼ kw. field

transmitter set acting as a source of sparks.

A typical series of spectrograms obtained during the engine research was reproduced in the paper. When the engine was detonating severely at 1400 r.p.m. with a normal fuel-air ratio, the spectrum produced was continuous but had superimposed upon it an ill-defined band spectrum. The ultra-violet band of water vapor was a conspicuous feature of this spectrum. When the engine was operating with slight detonation under otherwise the same conditions, a spectrum was obtained in which the continuous part was less intense and the banded part more distinct. The characteristic part of this spectrum was a narrow strip of bands superimposed upon the continuous spectrum. The bands that were measured were identified as the positive bands of nitrogen, which correspond to the normal nitrogen molecule with one electron removed (ionized nitrogen). This strip of nitrogen bands was produced by the ionizing effect of the spark plug, which was directly in line with the quartz window on the opposite side of the combustion chamber.

V. R. Jacobs, assistant manager, aeronautic department, Goodyear Tire & Rubber Co., who addressed the Airship Session on "Airship Transportation of the Future"

With the engine operating without detonation at 1400 r.p.m., the continuous part of the spectrum was not present.

With the engine operating on benzene with no detonation at 1400 r.p.m., the spectrogram showed a very strong continuous spectrum extending into the ultra-violet, its intensity being such that the characteristic hydrocarbon line and bands were completely masked.

With the engine operating without detonation at 1400 r.p.m., the most characteristic feature of the spectrogram was the absence of the ultra-violet band of water vapor.

A continuous spectrum was obtained extending from 4500 to 2800 Angstrom units for straight-run motor fuels burning under detonating conditions. The same results were obtained when using benzene as a fuel under the same running conditions but not detonating. The straight-run motor fuel running under non-detonating conditions gave no continuous spectrum.

The positive band spectrum of ionized nitrogen has been identified in the neighborhood of the electrodes of the spark-plug.

The three most sensitive lines of lead in the spectra of fuels containing ethyl fluid were found to be 4058, 3683 and 3640. The band spectra of lead molecules were conspicuous with high concentration of ethyl fluid, but were not present with low concentration.

The author expresed the opinion that: "The spectroscopic method could be developed, under more carefully regulated conditions than have been used in the past, for the estimation of lead concentration in motor fuels.

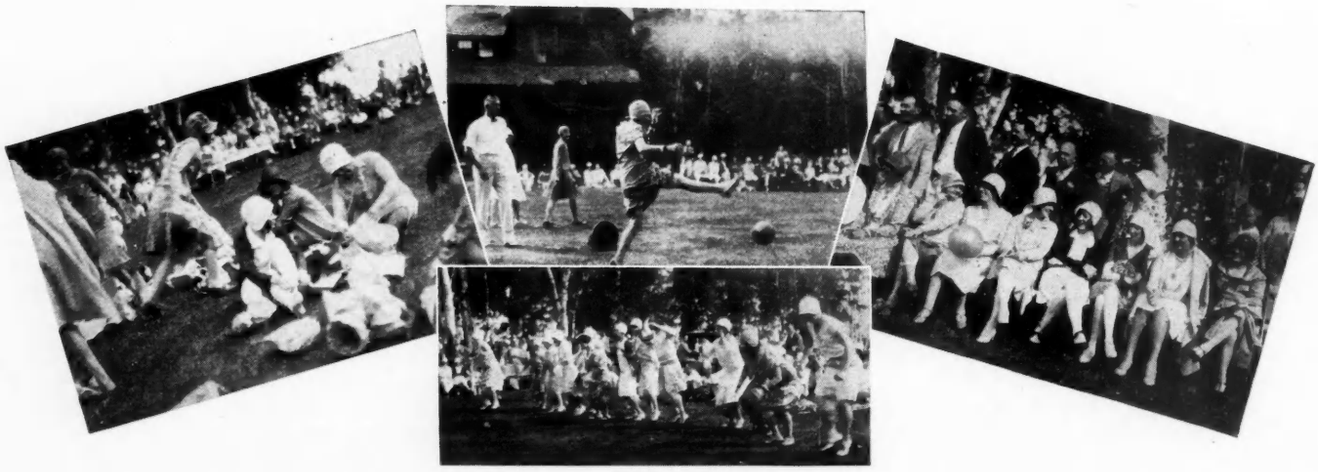
"Of the total energy developed by the combustion of motor fuels in engines, part is radiated away and the remainder is transformed into work in the cylinder. The radiations emitted may comprise widely different wave-lengths, from low-frequency radiations in the infra-red up to high-frequency radiations in the ultra-violet; and each flame has its own characteristic spectrum, according to the chemical changes occurring in it. The study of such spectra, whether in the infra-red, the visible, or the ultra-violet region, assists greatly in our interpretation of flame reactions.

"Since each element has a characteristic emission spectrum, it is possible to identify an element by the position of its spectrum lines. A standard is required to determine this position; and for this purpose the light from a spark between iron electrodes is usually used, the wave-lengths of all its lines having been determined with great care. The spectrum lines of the unknown element are measured by interpolation between two known iron lines; then we can see at once which elements are giving rise to the lines by referring to published lists of spectrum lines."

S. A. E. Summer Meeting

(Contined from page 3)

England, Mrs. P. S. Tice, Mrs. L. A. Chaminade, and Mrs. A. R. Kepler. Balloon and bag race, three men and three women, J. T. Greenlee, Mrs. J. T. Greenlee, E. Von Hambach, Mrs. E. Von Hambach, F. G. Whittington, and Mrs. G. N. Edgar. Volstead race, one man and one woman, A. A. Bull and Alice Brown. Stepping stones, one man and one woman, Clarence Bruce and Mrs. K. B. Boehm. Kangaroo balloon race, G. W. Yanss.



The 200 women in attendance at the meeting were enthusiastic participants in events of the field day

Just Among Ourselves At the S. A. E. Meeting

PAST-PRESIDENTS of the Society were plentiful at the Saranac sessions, but fewer chief engineers of passenger car companies were present than at any summer meeting in several years. J. H. Hunt, B. B. Bachman, H. L. Horning, David Beecroft, T. J. Litle, Jr., and William Guy Wall were the past presidents in attendance. Henry M. Crane, C. F. Kettering and H. W. Alden were missed as well as missing.

* * *

THE weather man gave the engineers only a fifty-fifty break this year. Rain played a prominent part in the activities two days out of four. The hardiest golfers batted out their 18 or 36 holes every day nevertheless.

The golf course, incidentally, was quite satisfactory to a majority of the players this year. Winter rules still prevailed and the greens were rough for putting, but plenty of good scores were turned in just the same. The course is a long one with several par four holes between the 425 and 450-yd. marks.

* * *

THE tennis tournament ran true to form, both in the victory of J. P. Nikonow and in the playing of the finals in rain and mud. The only question each year seems to be how much rain and how much mud will the racket wielders have to go through. We still claim that the famous doubles match at Spring Lake, in which Herbert Chase and ye editor swam to victory over Clarkson and Bates, holds the world's record in this respect —and we have "Photos by Lazarnick" to prove it.

INTEREST in and attendance at the technical sessions this year showed a big improvement over Quebec, where the low-water mark for all time probably was reached. Several interesting discussions developed which carried on into the lobbies after the sessions had closed.

* * *

FURTHER mergers and rumors of mergers were almost as numerous as the raindrops during the meeting. The Curtiss-Wright and the Brockway-Autocar negotiations broke in the newspapers while the meeting was on. We heard of at least two other combinations which are certain in the parts or accessory fields and talk of fair possibilities of several others.

* * *

E. P. WARNER, former Assistant Secretary of the Navy for Aeronautics, played a prominent and exciting part in this summer meeting. His appointment as editor of *Aviation* was made public; he was nominated to be president of the S.A.E. for 1930; he piloted the New England Section boat in the outboard motor boat races; he fell in the lake with his clothes on, and he presided at the airship session on Thursday evening when V. R. Jacobs of Goodyear set a new S.A.E. non-stop speaking record for number-of-words-per-minute. We seize this chance publicly to welcome Ed to the craft of business paper editors.

* * *

TO an engineer of the Firestone Rim Co. goes the prize for practical application of trade technique in everyday life. On the way up to Saranac, we learned that on all railroad trips he carries with him a rim tool for the express purpose of raising Pullman car windows. He says it works well. Perhaps the Pullman Co. could be prevailed upon to furnish each berth with one of these tools as standard equipment.

* * *

SPEAKING of golf, at least one group teed off around four-thirty or five o'clock one morning after having stayed up all night pouring over the geometry of abstruse technical problems.

* * *

WHATEVER anybody thought about the weather, the caddies or the room service, everybody was agreed that the blue-coated jazz orchestra was hot. It came as close as anything could to being the silver lining to the dark clouds on the rainy days, even if one or two lobby bridge players did try to use it as an alibi for trumping their partners' aces.

* * *

AT the risk of being sued for libel, plagiarism and what have you, we are constrained to reprint the following from the *Daily S.A.E.*, which Timken Roller Bearing Co. so ably produced this year:

"Why are you breaking that ice?" said F. W. Slack to E. H. Parkhurst.

"To have cocktails," said E. H. Parkhurst.

"And why have cocktails?" said F. W. Slack.

"To break the ice," said E. H. Parkhurst.

Isn't that a Peerless wisecrack?—N.G.S.

Inequality in *Apportionment of Gas Due Partly* to Carburetor Air Horn

It is blamed by several speakers at the Mixture Distribution Conference with causing a non-uniform flow up the riser. Fuel research men state findings.

THE Mixture Distribution Conference on Thursday morning was presided over by O. C. Berry, motor engineer, Buick Motor Co. Brief papers and discussions were contributed by carburetor and engine men, oil men and college research men. A good deal of the research work covered in the contributions is still in an incomplete stage, and results given were of a preliminary nature.

A point emphasized by several speakers was that the air horn of the carburetor tends to cause a non-uniform flow up the riser with respect to the axis of same, which leads to unequal distribution between the front and rear cylinders. The throttle valve when in a partly open position, if its axis is transverse to the engine axis, has a similar effect.

Dr. M. J. Zucrow, research associate of the Engineering Experiment Station of Purdue University, read a paper on "Mixture Distribution in Multi-Cylinder Engines." He pointed out the evil effects of non-uniform distribution, such as a reduction in the power output, increase in the specific fuel consumption and possible roughness of operation. Dry mixtures can be distributed uniformly quite readily, but it is impossible to obtain dry air-fuel mixtures under all conditions. If insufficient heat is supplied to the mixture, a portion of the fuel will remain unvaporized and will either deposit in the manifold or be carried along by the air stream.

Changes in direction and reversal of gas flow in the manifolds of multi-cylinder engines aggravate the tendency of the suspended fuel to condense, especially in regions of high pressure. The gaseous part of the charge accelerates and decelerates more readily than the suspended fuel, and reversals of gas flow introduce a time interval between the arrivals of the air and the entrained unvaporized fuel, hence the fuel may arrive at the port too late to pass through the valve.

Fuel in the liquid form cannot remain in the air stream below a certain minimum air velocity, which was found by Mock to be equal to 38 ft. p. s. for a steady, non-pulsating gas flow in a vertical pipe, and considerably higher, about 75 ft. p. s., after passing around a bend. There may be condensations of suspended fuel even though the mean gas velocity is high, because of uneven suction impulses and reversals of gas flow. Experiments by J. Liebel, in Germany, indicate that there is condensation of fuel at the inner radius of a bend when there is a change in the direction of flow. From his experiments, he concludes that condensation is a minimum if the velocity of the gas is kept constant and the path relatively straight. This conclusion seems rational, but is at variance with that of C. S. Kegerreis, who finds that better distribution is obtained at low engine speeds if the branches of a six-cylinder manifold are slightly larger than the riser.

Evaporation by preheating the air is practically ruled out by the high air temperatures required and the serious effect on the volumetric efficiency. Tests at Purdue University indicate that for a dry mixture the air must be preheated to 280 deg. F. (corresponding to a mixture temperature of 235 deg. F.). For this reason the hot spot has become the common means for vaporizing the fuel. The greatest demand for heat occurs during acceleration after the engine has been idling, when large quantities of cold air and liquid fuel suddenly enter the manifold, while the pressure within it is almost atmospheric, and while the hot spot may not supply the required amount of heat at this time, it heats up quickly, which is its chief merit.

Ricardo, in England, has attempted to solve the vaporization problem by a carburetor in which the air temperature is controlled in accordance with the manifold pressure (that is, with the load). When high power is demanded and the throttle is therefore opened wide, the heat supply is automatically shut off.

These men were among those seen at the Mixture Distribution Conference. They are, from left to right: P. S. Tice, C. L. Petze, J. B. Macauley, E. S. Marks, H. M. Jacklin

Others who attended the Mixture Distribution Conference included, left to right: E. D. Herrick, H. W. Best, D. P. Barnard, M. J. Zucrow and O. C. Berry

Since preheating the air is objectionable, and hot spots do not supply sufficient heat to completely vaporize the fuel, it follows that the induction system must be designed to distribute wet mixtures. This presents a difficult problem which is ordinarily solved by experimenting with different designs on particular engines.

The phenomena occurring in manifolds distributing wet mixtures can be studied to advantage on a two-cylinder engine having cranks set at 180 deg., and in which two explosion strokes therefore follow each other and are followed by two exhaust strokes. Ordinarily, the two inlet strokes overlap, and gas, therefore, flows through the riser continuously for more than 360 deg. of crank motion. During the next 360 deg. of crank motion it is stagnant in the riser, and the fuel then tends to deposit. If the manifold is symmetrical, cylinder No. 1 will receive a richer mixture, because its air stream can pick up any fuel deposited in the entire manifold during the stagnant period, while cylinder No. 2 can draw only on fuel deposited in its branch. This tendency to unequal fuel distribution can be partly overcome by designing the manifold so that the second cylinder has a separate branch, which does not communicate directly with the first cylinder. The action of a six-cylinder manifold can be studied with the aid of this two-cylinder example.

O. C. Berry some years ago suggested the possibility of obtaining uniform distribution by heating the fuel without heating the air. Some work along this line has been done in England recently in connection with the operation of a motor coach on kerosene. The fuel entered the manifold after being completely vaporized by the exhaust gases, and the fog-like mixture could be distributed much the same as a gas is distributed, with the result that the power obtained was only 5 per cent less than with gasoline, and the economy was the same.

The only points in multi-cylinder manifold design in regard to which designers are generally agreed are that sharp turns and sudden enlargements should be avoided, that the various branches should have the same lengths, that the induction impulses should occur at equal intervals, alternately in the two halves of the manifold, and that the gas velocity should be high enough to avoid excessive condensation without causing too high a frictional loss.

Detonation Study

D. P. Barnard, Fourth, of the Standard Oil Company of Indiana, talked briefly on an explorative research to determine the effect of air-fuel ratio on the maximum b.m.e.p. obtainable with different fuels without detonation.

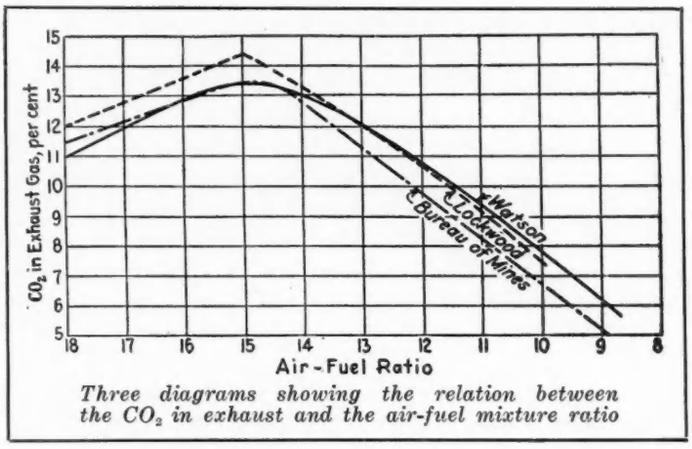
Using ethyl gasoline with 5 cc. of tetra ethyl lead, there was no detonation at any mixture ratio between 8:1 and 18:1. Plotting mixture ratio along the horizontal and b.m.e.p. above the vertical axis, a curve similar to a sine curve was obtained, the b.m.e.p. being a maximum for an air-fuel ratio of about 13:1. With fuels of lower anti-detonating value, the curve would be identical with that described up to the point where detonation began. If the mixture ratio was increased (leaner mixture), the throttle had to be partly closed to permit operation, thereby lowering the b.m.e.p. In this way the peak of the curve was cut off by a line sloping downwardly toward the lean mixture side of the scale. With very lean mixtures the throttle could be fully opened again, and the last part of the characteristic curve of each fuel again coincided with the curve for the highly anti-detonating fuel. Thus, while with the fuel of high anti-knock value, the maximum b.m.e.p. was obtained with a maximum ratio of about 13:1, with successively poorer fuels, from the knocking standpoint, the maximum b.m.e.p. is obtained at successively lower air-fuel ratios (richer mixtures). In another series of tests, however, in which another test engine was used, the m.e.p. fuel ratio curve showed two dips corresponding to air-fuel ratios of 10:1 and 13.5:1, with a slightly higher b.m.e.p. for intermediate ratios.

Air-Fuel Ratio Tests

H. W. Best, instructor in automotive engineering in Sheffield Scientific School, Yale University, presented a report on air-fuel ratio tests. He pointed out that the best way to determine the proportion of air to fuel received by an engine, or by an individual cylinder, is by making a test of the exhaust gas from the engine or the cylinder. Diagrams for determining the fuel ratio from the results of the exhaust gas analysis have been published by Dr. W. Watson and by the Bureau of Mines, both being based upon a large number of tests and analyses of exhaust gases of multi-cylinder engines.

Prof. Lockwood of Yale University has developed a similar diagram based on a theoretical formula from which the hydrogen and methane are eliminated by placing $H_2 = 0.38\ CO$ and $CH_4 = 0.13\ CO$. By Prof. Lockwood's method, three points on the chart are obtained, one being based on the oxygen content, the other on the CO content, and the third on the CO_2 content of the exhaust gases. Generally, these points are very close together, and if no errors of any kind were made, they would coincide. In applying the method, the center of the triangle formed by connecting the three points obtained is taken as the correct result. The three diagrams are superposed in the accompanying figure. Numerous measurements have been made at Sheffield Scientific School to check the accuracy of the diagram. By direct measurement the average ratio was 11.9 lb. of air to 1 lb. of fuel. The average air-fuel ratio ob-

tained from 31 samples by Dr. Watson's curve was 11.6; using the Bureau of Mines curve it was 12.3. By Prof. Lockwood's diagram the first 19 samples gave an aver-



Three diagrams showing the relation between the CO_2 in exhaust and the air-fuel mixture ratio

age ratio of 13.2, the last 12 an average ratio of 12.6.

Charles Louis Petze, Jr., of the Automotive Engineering Staff of Massachusetts Institute of Technology, presented a written discussion on the paper by Mr. Best. He said he also had made determinations of the air-fuel ratio, using both the exhaust gas analysis and the air and fuel measurement methods. Using a special single-cylinder combustion study engine, samples of the exhaust gas were analyzed for carbon dioxide, oxygen, carbon monoxide, hydrogen and methane, the nitrogen content being determined by the difference. A complete gas analysis thus being obtained, the air-fuel ratio was calculated by means of the usual stoichimetric balance method, the chemical composition of the gasoline having been previously determined.

With the other method, the air and gasoline supplied to the engine were measured, the gasoline being evaluated by recording the time necessary for the engine to consume a definite quantity of the fuel, the air by the pressure drop through an orifice in a plate placed in a chamber in the carburetor inlet line. The sampling of the exhaust was synchronized with the period of the fuel consumption test.

The differences between the results obtained by the two methods ranged between 1 and 4 per cent. The orifice method tends to give slightly high values, while the exhaust gas analysis tends to give slightly low values, and the errors with the two methods are likely to be cumulative. The conclusion is therefore drawn that the two methods give check results, as the differences in the results obtained are commensurate with the inherent errors of the two methods.

Commenting more directly on the paper by Mr. Best, Mr. Petze thought it inadvisable to analyze the exhaust gas for only carbon dioxide, oxygen and carbon monoxide, especially when operating with rich mixtures. With such mixtures, hydrogen and methane appear in considerable quantities in the exhaust gas, and should be considered. Empirical formulas, such as that used by Mr. Best, are only approximate, and, therefore, inaccurate. Moreover, analysis of the exhaust gas for the two constituents is comparatively simple.

Mr. Petze further said that the air-fuel ratio should not be determined from curves based on previous tests in which different fuels and different engines were used, as this involves an error. By using the usual chemical element balances, the air-fuel ratio is quickly determined. The correct value is given by the following equation, viz.,

$$\text{Air-Fuel Ratio} = \frac{(0.0305)\ (\%\ N_2)\ (\%\ C)}{(\%\ CO_2 + \%\ CO + \%\ CH_4)}$$

where % *C* is the per cent of carbon by weight in the gasoline, while the other factors are volume percentages in the exhaust gas.

H. M. Jacklin, associate professor of automotive engineering, Purdue University, who presented a paper on "Balancing of Power Output in Multi-Cylinder Engines," said the real object when seeking to improve distribution was a certain rhythm of sound and torque reaction. What actually takes place in the cylinders can be determined only with the aid of suitable measuring tools. He had taken numerous indicator records with this object in view, a considerable number of them on the road. Records were taken from all four cylinders of an engine mounted on a car. When the engine was being idled at 1600 r.p.m., cylinder No. 1 was doing most of the work, and there was considerable misfiring in the other cylinders. When driving the car at 20 m.p.h. over a level road, cylinder No. 1 was still doing most of the work, while No. 4 misfired every third or fourth time. On a hill all four cylinders fired well, delivering substantially equal amounts of power.

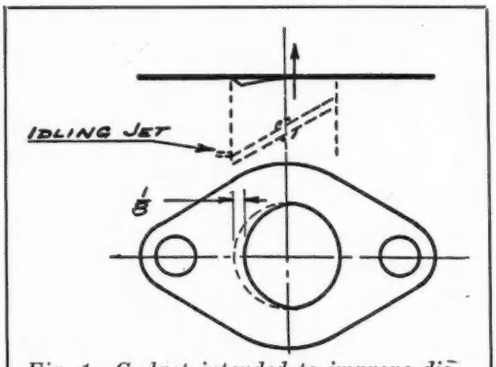


Fig. 1—Gadget intended to improve distribution and power balance in engine

Although the performance of the engine was fairly satisfactory, a baffle was inserted between the carburetor and inlet pipe with a view to its improvement. It consisted of a sheet of copper plate with a lip turned down over the idler nozzle (Fig. 1). This lip was intended to carry the raw fuel to a point 90 deg. around the standpipe, so it might travel up toward the manifold with a better chance of equal distribution between the several cylinders. Diagrams taken under idling conditions showed that the scheme was successful under these conditions. At 20 m.p.h. on level road the conditions were rather unsatisfactory, however, although an improvement was shown over results obtained without the baffle under otherwise similar conditions. Prof. Jacklin then inserted between the carburetor and the manifold a flanged fitting of the design shown in Fig. 2. The results were quite astonish-

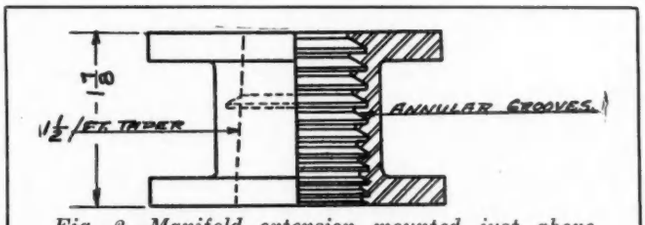


Fig. 2—Manifold extension mounted just above carburetor of four-cylinder engine. No restriction of passage, but annular grooves serve to equalize fuel flow

ing. Not only was the power greatly increased, but a nasty rough spot at 38 m.p.h. disappeared and the fuel mileage was increased from about 15.5 to 17 miles per gallon.

In concluding his paper, Prof. Jacklin outlined a research program which it is proposed to carry out at Purdue and on which he asked for suggestions. It is proposed to investigate distribution itself as follows:

1. Providing a relatively simple and easily used indicator whereby diagrams may be obtained from all cylinders. Another similar indicator will probably be used to obtain records of manifold pulsations.

2. Providing accurate air and fuel measuring devices.

3. Block off all cylinders but one.

4. Make runs on the one cylinder, observing the items under No. 2, but varying the air and water temperatures, load, speed and spark advance, taking diagrams for each condition, in order to:

5. Obtain characteristic diagrams for the particular combustion chamber, so that,

6. With all cylinders in operation, a measure will be had as to the sort of mixture supplied to each.

E. T. Marks, chief engineer of the H. H. Franklin Mfg. Co., presented some data on changes made in the Franklin manifold, and on the results. The manifold previously used gave fairly uniform distribution, as shown by exhaust analyses with the Orsat apparatus and by tests with thermocouples. It had a number of sharp turns, however, which tended to break up the charge.

The new design has the same good distribution qualities as the old one, and offers the advantage of less resistance to gas flow, resulting from easier turns where the outlets join the runner. These easier turns were made possible by placing the runner further from the engine. Adoption of this new manifold increased the power of the engine by 2.5 per cent at 1000 r.p.m., the gain rising to 26.3 per cent at 3400 r.p.m.; in conjunction with carburetor improvements it increased the fuel mileage by 2.1 miles per gallon at 20 m.p.h. and 0.25 miles per gallon at 60 m.p.h. Experiments with glass section manifolds of this type (of square cross section) indicate that a dry charge is obtained quickly, and that distribution is quite uniform.

J. B. Macauley, Jr., of the Chrysler Corp., described some tests of the Siemens & Halske combustion indicator to determine its value for checking mixture distribution. With this instrument part of the exhaust gas is passed through an electrical apparatus in which any unconsumed fuel in it is burned, and the resulting rise in temperature is taken as an index of the amount of excess fuel in the charge. Evidently such an instrument can be used only for determining mixture proportions in cases of rich mixtures. The instrument was calibrated by applying it to a Delco-Lite single-cylinder engine.

Later, the apparatus was used on a six-cylinder engine to study distribution. It was found that while the air-fuel ratios in three cylinders at one end were substantially equal, the ratios for the other three cylinders were quite different. By turning the air horn at the inlet to the carburetor through an angle of 180 deg., the mixture ratio relations were reversed, the cylinders which previously received a rich mixture now receiving a lean one, and vice versa. This showed that the unequal distribution was due to unsymmetrical flow through the standpipe. By eliminating the air horn, so that the flow was entirely vertical, the differences could be substantially eliminated.

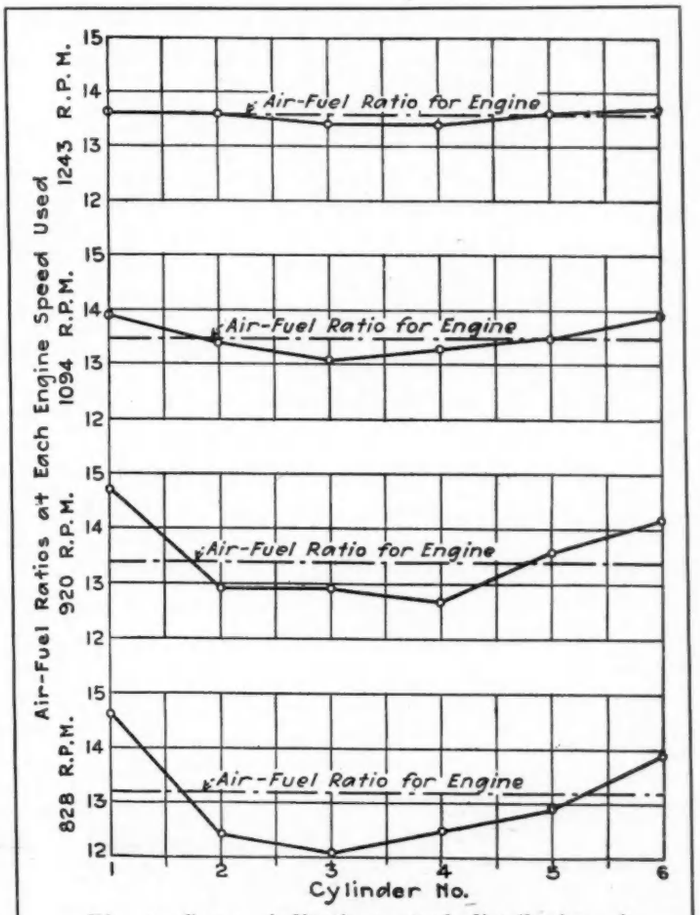


Fig. 3—Curves indicating actual distribution of fuel charge to individual cylinders (see page 27) The air-fuel ratio of the engine as a whole is shown for each speed of operation. On account of the test set-up and conditions, the variations exhibited are confidently believed to be caused by the actual flow of the charge in the manifold itself

P. S. Tice, of the Stewart-Warner Speedometer Corp., also discussed the subject of distribution. He pointed out that distribution of the charge really begins in the T above the carburetor and that the air horn must be so designed as to insure symmetrical flow of charge through this T. The speaker said he had made a study of distribution in eight-in-line engines with the usual 2-4-2 arrangement of the crank, and had found that there is a serious disproportion between the piston movement, or displacement, and the fuel discharge head when two inlet strokes overlap, which interferes with distribution. Mr. Tice has designed an instrument which will enable him to make a differential record of the m.e.p.'s in all of the cylinders of an engine. An automatic reference is obtained, giving the relative performance of each cylinder during a brief time interval together with the load on the engine (inlet manifold vacuum) and records from which the momentary speed and acceleration of the vehicle may be computed. At the same time that these records are made, three pressure reference lines are traced on the tape: viz., atmospheric pressure, inlet manifold pressure corresponding to half load and inlet

(Continued on page 27)

Jordan Announces Three Car Models At Prices From *$1,795 to $2,795*

Two eights and one six-cylinder type are being offered with a number of new features introduced in sales policy and retail purchase conditions.

JORDAN MOTOR CAR CO., INC., is offering this month three lines of cars, comprising an eight-cylinder model known as the Great Line Ninety, which is similar to last year's Model G; an eight-cylinder model known as the Standard Line Eighty, and the well-known Jordan Six.

As regards the leader of the Jordan line, the Great Line Ninety, it differs from the model which it supersedes in having the engine mounted on rubber blocks, and that the standard equipment includes a Vision-All double windshield cleaner and a back-up light.

The second eight-cylinder model, the Standard Line Eighty or Model T, is furnished in only two body types, a five-passenger sedan and a standard coupe, both equipped with wood wheels and spare rim, and both listing at $2,095.

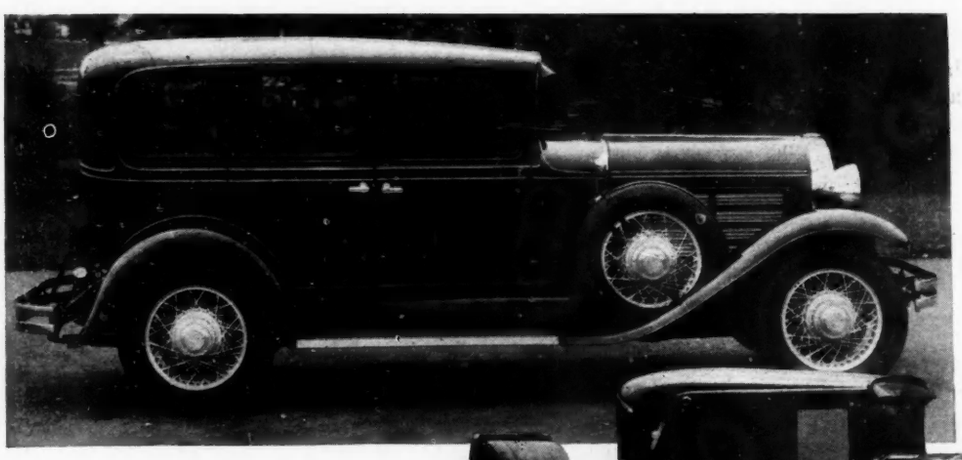
The Jordan Six also will be furnished in two styles of body only, both equipped with wood wheels and spare rim, a 5-passenger sedan and a standard coupe, both listing at $1,795 f.o.b. factory.

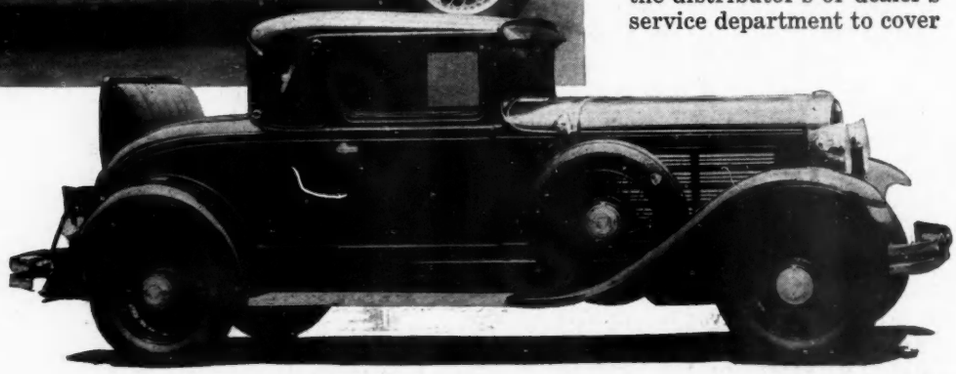
The Great Line Ninety, which has a bore of 3 in. and a stroke of 4¾ in., and a wheelbase of 125 in., comes in nine different body types, with items of standard equipment and prices as given in the following tabulation:

Model	Equipment	List
7-Pass. Limousine	With glass partition at back of front seat, leather front seat upholstery, wood wheels and spare rim	$2,795
7-Pass. Sedan	Wood wheels and spare rim	2,695
5- Pass. Sedan	Wood wheels and spare rim	2,395
Sport Sedan	Wood wheels, trunk and spare rim	2,695
Standard Coupe	Wood wheels and spare rim	2,395
Convert. Coupe	Wood wheels and spare rim	2,595
Speedboy Phaeton	Lacquered wire wheels and lacquered radiator shutter. Price includes two spare wheels with tires, tire covers, trunk and bumpers	2,895
7-Pass. Touring	Wood wheels and spare rim	2,995
Playboy Roadster	Lacquered wire wheels and lacquered radiator shutter. Price includes two spare wheels with tires, tire covers, trunk and bumpers	2,695

A number of new features have been introduced in the Jordan sales policy this year. The car invoice will carry a net charge of $25 per car for advertising, and $5 per car for an owner's registration card. This $5 owner's registration charge will be refunded when the card, completely filled out, is returned to the factory.

In addition, the distributor and dealer will collect from the retail purchaser a handling charge of $25 which is to be credited to the distributor's or dealer's service department to cover





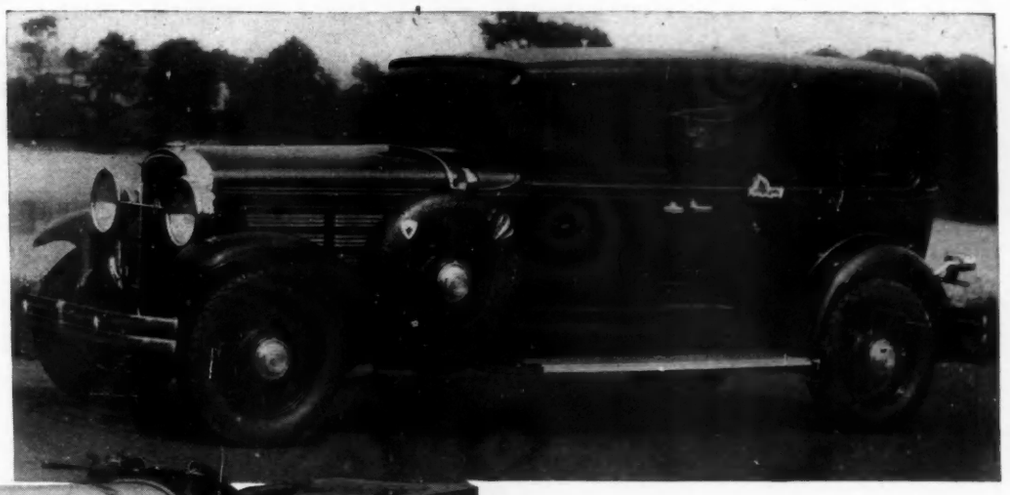
Above — New Jordan Standard Line 80 five-passenger sedan

Right—Jordan Model T three-passenger coupe

unloading and inspection of new cars and service charges on the car after delivery to the owner.

The new Model T, with a wheelbase of 120 in., has a tread of 56 in. at the front and of 58 in. at the rear. It is equipped with an eight-cylinder engine having a bore of 2⅞ in. and a stroke of 4¾ in.

All the cylinders and crankcase are cast in a block, while the cylinder head is a separate casting.



Above — Seven-passenger sedan model of the Jordan Great Line 90

Left — Jordan Playboy model in the Great Line 90 class

The camshaft also is made from a drop forging and is completely machined. It is supported in five bearings of the following diameters (front to rear): 2 5/16, 2¼, 2 3/16, 2⅛ and 1¾ in. The camshaft bearings are line-reamed in the case. Oil holes are drilled through the crankcase webs, through which oil is fed under pressure from the main bearings to the camshaft bearings. The camshaft and generator are driven through a toothed chain of 0.400-in. pitch, 1¼ in. width and 75 links length, which can be adjusted from the outside at the generator. The flywheel is made of semi-steel, statically balanced, and has a steel starter gear shrunk on.

The carburetor is of the plain tube type, with idle and high speed adjustment, and with an accelerator pump. It is regularly fitted with an air cleaner. Fuel feed is by means of a pump with sediment trap, mounted on the right side of the engine and operated from the camshaft. The fuel tank, with a capacity of 17½ gal., is carried on the frame at the rear end. An electric fuel gage is mounted on the instrument panel.

Lubrication is by force feed to all crankshaft, camshaft and connecting rod bearings, with positive flow to the timing chain and sprockets. Piston and piston pins are lubricated by spray from the connecting rods. The oil capacity of the engine is eight quarts.

The electrical equipment comprises the usual six-volt generator with third-brush regulation, and a starting motor fitted with Bendix drive. A vibrating relay is furnished which gives an audible warning and opens the circuit in case of a "short" on the lighting lines. A 15-plate battery with a capacity of 105 amp.-hr. is located under the left front seat.

Front view of the Jordan Standard 80

The clutch is of the single-plate dry type, 9¾ in. in diameter, and requires no adjustment except for pedal clearance at the floor boards. The clutch throw-out has a ball bearing, while a roller bearing pilots the clutch shaft. To prevent too much heat being transmitted to the clutch spring, the latter is insulated from the pressure plate.

A three-speed-forward-and-reverse selective sliding gear type of transmission is fitted, with all gears made of chrome steel. The standard shift is employed.

The propeller shaft is made of seamless steel tubing 2 in. in diameter, with electrically welded forged ends. Two universal joints of the metallic, oil-lubricated type are used.

The rear axle is of the semi-floating type with pressed steel banjo housing. The axle shafts are made of high alloy chromium steel, heat-treated, with splined fits to the differential side gears and keyed fits in the wheel hubs, the diameter at the outer bearing end being 1⅜ in. The Hotchkiss drive is employed.

Four-wheel hydraulic internal brakes, 14 by 1¾ in., are fitted. In addition there is a transmission brake operated by hand. The steering gear is of the worm and sector type. The ratio of the steering gear is 16 to 1.

The frame is made up of pressed steel side channels made of 5/32-in. stock and having a maximum depth of 7 in. There are six cross members, three of these being gusseted pressed steel channels and three torsion resisting tubular members, one of the latter being located at the center and one at each end.

Negative Caster *Angle* Produced by Axle *I-Beam* Rotatory *Motion*

Certain otherwise unaccountable "wanderings" of cars are believed to be due to this change of angle. Progress is reported in headlight glare and riding quality research.

By ATHEL F. DENHAM

FOUR papers were presented at the Chassis Conference, three being in the form of reports on progress in research activities. H. H. Allen, of the Bureau of Standards, read one on headlighting; Dr. Fred A. Moss, of George Washington University, had a paper on riding qualities, and J. M. Nickelson, University of Michigan, one on front wheel alignment research. The last-named report was presented by B. J. Lemon in the absence of Prof. Nickelson. In addition, a description of the application of a new device, the Gyro-Accelerometer, to the measurement of riding quality, was given by Merritt L. Fox, Iowa State University, while William B. Barnes, research engineer, Auburn Automobile Co., offered a new method of determining what happens to a front wheel I-beam on the road and quoted certain of the results already obtained.

Among those prominent at the Chassis Conference were, from left to right: Merritt L. Fox, Dr. Fred A. Moss, H. H. Allen and Fay Chandler

Unfortunately, all of the papers and all of the discussion, after that following Mr. Allen's paper, had to be abbreviated or eliminated by Fay Chandler, Ross Gear & Tool Co., who presided, due to a conflict of the session's time with that of important sports events.

Mr. Allen's report included a summary of the relationship of different variables as related to glare and visibility, taken with one car alone, and with another car of the same type approaching in the opposite direction. According to Mr. Allen, visibility decreases with the horizontal spread, and increases only as the cube of the source intensity, indicating the importance of confining the light to just exactly where it is needed. In the presence of glare, Mr. Allen said, the visibility seems to be independent of beam intensity, and also of the horizontal spread. Under the same conditions, visibility decreases with increasing glare from 150 ft.

As to the working out of a single beam which would meet all headlighting conditions, Mr. Allen expressed a doubt that this could be done. Mr. Allen also referred to the work of the Bureau of Standards on glare research through the medium of windshield photometers, especially in connection with the wide divergence from state law specifications found on many cars as a result of these tests. In the discussion later, he added, however, that the driver can stand considerable glare providing he has sufficient light on the ground ahead of him.

The question of better maintenance of present headlighting equipment also was introduced by Prof. H. M. Jacklin, of Purdue University. R. W. Brown, Firestone Tire & Rubber Co., suggested that the chain service stations now growing up would be an excellent source of immediate contact for the betterment of lighting equipment. Mr. Chandler thought that in addition to this, storage garages, which, he said, in the future probably would have considerably more to do with car servicing, would also prove of valuable assistance.

The report of the sub-committee on front wheel alignment was mainly of a "progress" nature. Mr. Lemon read a letter stating that in investigations of cars at the General Motors Proving Grounds, 50 per cent were found not to correspond to the manufacturers' specifications as to caster, camber, etc. The committee also found that there is no adequate reliable instrumentation which under average conditions will give reproducible results on front wheel alignment checks. The sub-committee is trying now to devise instruments for this purpose. Checks are made on cars when new, and every 5000 miles thereafter, with photographs of tire wear. Mr. Chandler expressed a hope that the work of the committee would not be confined to the relation of alignment with tire wear.

Mr. Barnes' paper, an abstract of which follows, was accompanied by a number of slides and a motion-picture reel. Certain of the most interesting facts learned were that under some conditions the rotatory motion of the axle I-beam actually produces a negative caster, and that the instantaneous center of rotation may be anywhere within a 12-in. circle or more.

Dr. Moss' report dealt with the determination of riding quality from a physiological angle. To attack the problem, "muscle fatigue" was used as a criterion,

it being indicated when the combining power of the CO_2 in the blood decreases, also when the reaction time increases, as shown by the use of an electric tap key and the electrically contacted and balanced "wabble" platform. Dr. Moss suggested that the CO_2 test and determination of metabolism were probably the best methods of judging muscle fatigue. Actual test results on cars were not available.

Gyro-Accelerometer Unique

The Gyro-Accelerometer described by Mr. Fox differs from the usual type of riding quality determining instruments in that it depends on the angular motion of the car rather than its vertical component, which Mr. Fox stated he believed was much closer to actual conditions. The instrument itself works on the principle of the gyroscope, the precession of the ring being recorded on a moving recorder strip. The slope of the curves on the strip would then give the angular acceleration, and since the gyroscopic mass is known, the producing force can be quickly determined from the fundamental formula F-MA. An improvement on the instrument, suggested by Mr. Fox, is the use of a wire in a constant magnetic field in place of the pencil. Since the motion of the wire produces a voltage directly proportional to the rate of movement, a voltmeter would give the actual relative acceleration very quickly.

An abstract of Mr. Barnes' paper follows:

Mr. Barnes spoke on "Front Axle Movements and Front End Behavior." He said that probably the most important factor in front wheel alignment was the caster angle. In one particular design with which he happened to be familiar, if this was made less than 1½ deg., the car wandered all over the road, while if it was made more, a very annoying low-speed shimmy was likely to develop. The necessity for such close adherence to a standard is expensive in manufacture (or in service, if neglected in manufacture). The fact that practice with respect to caster angle varies, although axle and wheel design is standardized to a considerable extent, seems to indicate that the proper caster angle largely is dependent upon factors outside of axle design.

The progress report of the Front Wheel Alignment Sub-Committee made it evident that no car can be depended upon to retain its front wheel alignment for long, but what is generally less known is that in service the front axle oscillates constantly around an axis, so that the standard or intended caster angle is only an approximate means of the range of inclinations passed through by the axle. This was proven by means of a simple registering device. It makes a moving chart that permits a graphical analysis of rotary vibratory motion of the front axle. The curves obtained may be analyzed graphically in a simple manner.

Test Results Surprise

Two surprising facts are indicated by this machine:

1. The axle as a whole may rotate forward as much as 5 deg. This may occur during brake application, when the axle may remain deflected for several seconds, or it may occur upon striking an obstruction, when its deflection is, of course, momentary. During this period the caster angle is negative, which, of course, is utterly ruinous to any steering control. This may account for certain otherwise unaccountable "wandering" of some cars under severe deceleration. That they do not wander more is probably due to the stabilizing action of the greatly augmented friction at the knuckle pin bearings due to the braking torque. However, this beneficial friction does not exist under the conditions of the momentary deflection, and the fact that many cars are very unstable after striking obstructions may be accounted for in this manner.

2. The height of the instantaneous center of rotation may vary from a point near the level of the spring main-leaf to a point 4 or 5 in. above it. The rule seems to be that as long as there are no vertical components to the reaction on the axle, the center remains low. In other words, during braking on a smooth pavement, the center of rotation is generally about the spring main-leaf. Striking an obstruction or depression, however, raises the instantaneous center of rotation. This, of course, is rather disconcerting, when it is remembered that the center of the front joint of the drag-link should be on this center if the steering gear is to be independent of spring action.

The designer must judge the mean height of this instantaneous center of rotation and place the drag-link front joint there. Since braking reactions are most easily singled out, the joint is generally so located that the car will not steer into the curb when the brakes are applied. If the steering is severely disturbed when a wheel drops into a hole, the blame is usually attached to the springs, shock obsorbers or steering gear.

The conclusion drawn from the experiments carried out is that if the caster angle could be held constant it would not be necessary to limit its value very closely; a tolerance of plus and minus 2 deg. might be permissible. Any trouble that occurs when the normal caster angle is not closely limited is directly due to the extreme values assumed by it in operation.

Ruxton Mechanical Details

SOME information on mechanical features of the front-wheel driven Ruxton car additional to that already printed in *Automotive Industries* has been issued by J. E. Roberts, general manager of New Era Motors, Inc., manufacturer of the car.

The frame side rails are made of 5/32 in. stock and are 6 in. deep. Nine cross members are used, eight of these being of the channel type and one tubular. All frame members are of carbon steel. The front drop-forged axle, as well as the rear tubular one, is of molybdenum steel. All cars are equipped with six Budd disk wheels. The engine is mounted on rubber cushions.

All springs are half-elliptic and made of chrome-vanadium steel, the front springs being 37 by 2 in. and the rear spring 55 by 2 in. Running boards are omitted because of the lowness of the frame, but leather mud splashers are provided on all fenders.

The four-wheel brakes are of the hydraulic type and act on 15-in. drums. The rear wheel brakes can be operated also by a lever, which is located on the left side of the driver's seat. The road clearance is 10 in.

An Exide 6-volt, 110-ampere-hour battery is being used. Lights include two headlamps with 12-in. lenses, fender lamps and a rear lamp. The rear light includes a stop and back-up signal. The instrument panels are indirectly lighted with independent control switches.

An oil filter is stock equipment. Gasoline is carried in a 16-gal. tank in the rear and supplied to the carburetor by a fuel pump. Additional stock equipment includes a gasoline filter and an air cleaner. The carburetor is a Zenith.

The radiator has a tubular core and a chrome-plated shell, completely covering the front-wheel transmission and gear box. The water capacity is 5 gal. Water circulation is controlled by a thermostat on the cylinder head, and is effected by a gear-driven centrifugal pump at the front of the block.

Cooperative Fuel Research Tests Reported by *Bureau of Standards*

Volatility of various gasolines and its effect on engine starting and acceleration, and crankcase-oil dilution are among the subjects receiving attention.

ALL of the papers presented at the Research Session held on Friday morning were by members of the Bureau of Standards staff. The session opened with the reading of a review of the cooperative fuel research work which has been carried on at the Bureau since 1918. The review was prepared by Dr. Dickinson, who, however, was not present at the meeting. It was read by H. K. Cummings.

Dr. O. C. Bridgeman read two papers, on "Volatility Data on Natural Gasoline and Blended Fuels" and on the "Present Status of Equilibrium Volatility Work at the Bureau of Standards." Donald Brooks, another member of the Bureau of Standards staff, read two papers, one on "Horsepower Correction for Atmospheric Humidity," and the other one a "Program for Design Factor Engine Acceleration Tests." H. L. Horning presided at the session.

In his review, Dr. Dickinson stated that the cooperative fuel research was started in 1918, the National Automobile Chamber of Commerce and the American Petroleum Institute furnishing the funds, and the S.A.E. administering them and watching the technical program while the Bureau of Standards undertook to carry on most of the research work. The first project undertaken was to determine what was the best gasoline as regards volatility, considered on a broad economic basis; in other words, what grade of gasoline would afford the maximum number of car-miles of transportation per barrel of crude oil used in its production. Four test fuels were selected, covering the whole range of volatility, and these were tested by members of the Bureau of Standards in four different cars, both in summer and winter, as well as by ten automobile manufacturing companies.

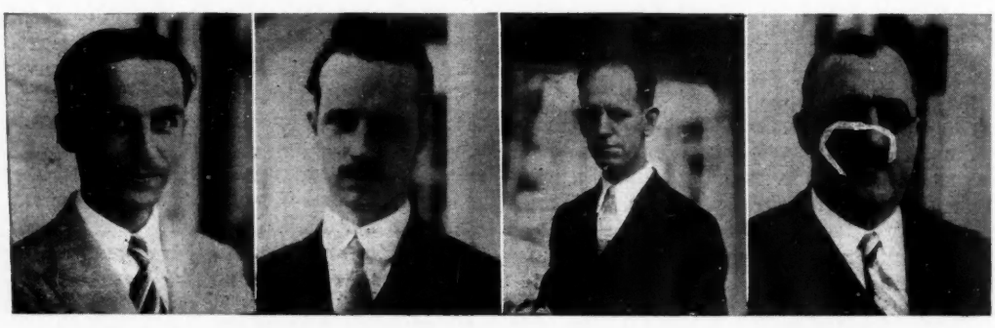
From this survey, it was concluded that economy dictates the use of as heavy a fuel as possible but that a practical limit in this direction is set by the dilution of crankcase oil and the difficulty of starting.

The committee then decided to make a study of crankcase-oil dilution. Data were already at hand from the analysis of samples secured in the tests mentioned above. A carefully arranged program of laboratory tests was supplemented by road tests, and conclusions were drawn as to the factors that chiefly affect dilution, and rules laid down as to how it can be minimized.

The third major project of the program consisted of an investigation of the effect of initial volatility on engine starting. To make this research of tangible value, it was necessary first to devise a method of measuring the volatility of the fuel which would give results comparable with those obtained in the engine manifold. Such a method was devised and after a series of careful comparisons it was found that the same result could be obtained from the standard A.S.T.M. distillation test.

Another phase of this project dealing with the effect of fuel volatility has to do with the effect of this property on the acceleration and general behavior of the engine. Naturally it is more difficult to secure quick pick-up, which means maximum engine acceleration, with the heavier or less volatile fuel simply because it is more difficult to control the mixture ratio.

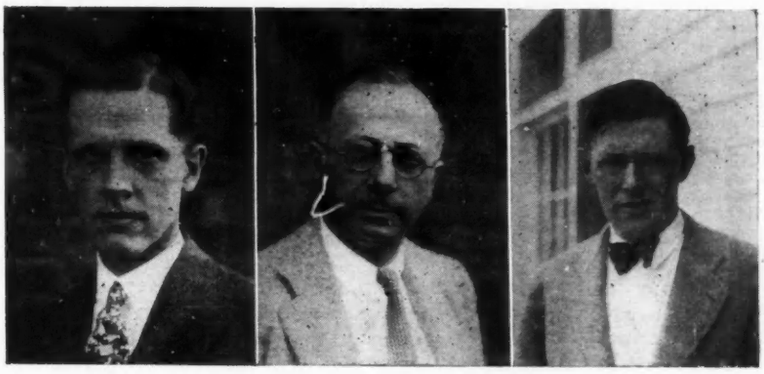
A project also was undertaken to determine whether the intermediate range of volatility, as represented by the 50 per cent distillation point, has a significant influence on engine acceleration. A study of this point has shown that, while there is some influence of this sort, the effects noted are somewhat erratic and seem to depend upon accidental rather than essential features of design and operation. In view of this result, a program is now under way for the analysis of the performance of a number of typical engine designs.



Herewith are pictured four of the men who participated in the Research Session. They are, from left to right: Donald Brooks, O. C. Bridgeman and H. K. Cummings, all of the Bureau of Standards, and H. L. Horning, president of the Waukesha Motor Co.

The latest of the cooperative-fuel-research projects and the one now occupying most of the time of the Bureau staff is that of deciding upon satisfactory apparatus and technique for the measurement of the knock characteristics of fuel. This project is now in active progress, but final results are not to be expected for some months.

In the paper on "Horsepower Correction for Atmospheric Humidity," it was shown that this correction is relatively as important as the correction for barometric pressure. Tests were made on a six-cylinder passenger car engine and a four-cylinder truck engine. In the tests, the humidity was introduced artificially into the carburetor air. In all tests, maximum power and optimum spark advance were found by one of two procedures: *(a)* by plotting the results taken at from six to eight values of the spark advance for each humidity and air-fuel ratio or *(b)* by trial.



These men were prominent at the Transportation Session. They are, from left to right: H. F. Fritch, Nathaniel Mallouf and R. E. Plimpton

Under one particular condition an increase in power was obtained by introducing water vapor with the air. When using a certain small nozzle in the carburetor a very lean mixture was obtained, with the result that the power from the engine was considerably less than could be obtained with a richer mixture. Introducing the water vapor then was equivalent to enriching the mixture, and the power output, therefore, increased with the moisture content of the air.

Atmospheric Humidity Tests

The tests were conducted on the supposition that humidity in the air would decrease the power output, because the water vapor replaces an equivalent amount of air (nitrogen and oxygen) and with less oxygen taken into the cylinders, less fuel can be burned and less heat will be generated. Following are the conclusions drawn from this investigation:

(1) This work definitely shows that failure to allow for the effect of differences in atmospheric humidity may introduce errors as great as would be occasioned by failure to correct for changes in atmospheric pressure. Under extreme conditions, either correction may amount to nearly 10 per cent of the indicated power.

(2) Under all atmospheric conditions normally encountered in automotive testing, humidity may be allowed for by deducting the observed pressure of water vapor from the barometric pressure used in the power computations.

(3) The proposed correction represents the observed effect of humidity well within the usual precision of measurements, as the indirect effects of humidity apparently cancel one another, at least in the automobile range of compression ratios.

(4) In correcting engine-performance data obtained at different air-fuel ratios, the fuel-flow values must be multiplied by the same coefficient as the power values.

(5) Optimum spark advance increases linearly with increasing humidity.

A number of alignment charts were given in the paper which permit of obtaining the humidity from psychrometric data in a simple manner.

Data on fuel volatility have been given in previous papers by Dr. Bridgeman. The research work on this subject has been extended recently to natural gasoline blends which are unusually volatile and require temperature measurements below the freezing point, and it was this phase of the investigation which was covered in the paper on volatility data. Information was included relating to natural-gasoline blends, on natural-gasoline aviation-fuels and on blends with ethylether. The results on these fuels were in good agreement with the relations previously obtained for less volatile fuels.

Volatility as used in connection with the equilibrium-air-distillation work is defined as the temperature at which a given mixture of air and fuel vapor will be formed under equilibrium conditions at a pressure of one atmosphere from any mixture of liquid fuel and air supplied when a given percentage is evaporated. Accordingly, the lower the temperature corresponding to these conditions is, the more volatile is the fuel.

Equilibrium-air-distillation data were presented in the form of ratios of the A.S.T.M. temperatures in degrees absolute to the E.A.D. temperatures in degrees absolute corresponding to 16:1 resultant air-vapor mixtures or at common percentages evaporated. The averages are given in the table below and are compared with the previous ratios.

TABLE 1—TEMPERATURE RATIOS, T_{astm} / T_{16}

	Percentage								
	10	20	30	40	50	60	70	80	90
Average	1.316	1.322	1.331	1.339	1.352	1.365	1.383	1.409	1.448
Previous Ratios	1.303	1.330	1.345	1.359	1.369	1.374	1.388	1.410	1.451

Ratios Constant

Considering the diversity of samples, the ratios at each percentage evaporated were very constant and the averages were in good agreement with those previously obtained for the work above 0 deg. cent. The ether blends showed a somewhat greater deviation from the average than the other fuels, but the disagreement was not very marked. The variations in the ratios seemed to be attributable in part to differences in the slopes of the A.S.T.M. distillation curves and in part to a variation of the ratios with temperature.

The values of the temperature ratios for 8-1, 12-1 and 20-1 resultant air-vapor mixtures were in excellent agreement with values computed from the 16-1 ratios by means of the relations previously found, namely

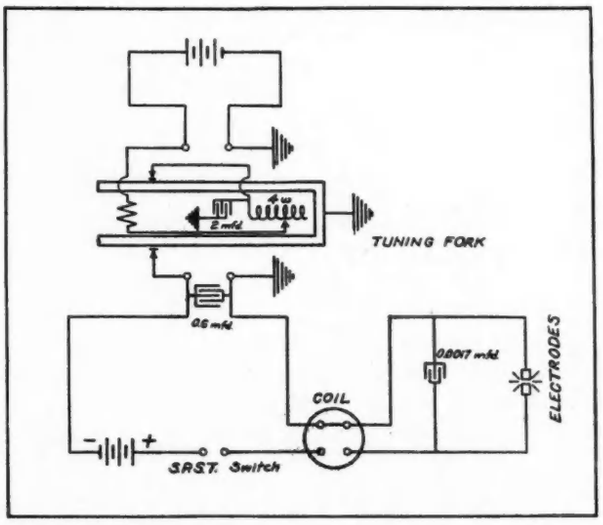
$$R_{16} = 0.987\ R_{20} = 1.015\ R_{12} = 1.037\ R_{8}$$

dew-points of 16-1 mixtures of the fuels with air were obtained by extrapolation of the equilibrium-air-distillation lines to 100 per cent evaporated and were given in a table together with the corresponding 90 per cent A.S.T.M. temperatures corrected for loss. The ratio of this latter value to the dew-points of 16:1 mixtures averaged 1.417, the average deviation from this ratio

being 0.004.

The second paper by Dr. Bridgeman was of the nature of a summary of the work on fuel volatility which has been carried on at the Bureau of Standards since 1922. The principles underlying this work were explained by him as follows:

"Volatility is a measure of the tendency of a substance to evaporate or to change from liquid to vapor under given conditions. It is one of the fundamental properties of a substance. Although commonly expressed in terms of vapor pressures, it can equally well be expressed in terms of other variables, such as temperatures corresponding to various mixture ratios with air at a given total pressure. The volatility of a one-component system like water will be the same, at any given temperature, regardless of how much of the water has been evaporated. This is not true of a liquid having several components, since the more volatile constituents will evaporate more readily, leaving the residual liquid less and less volatile as evaporation progresses. With a substance like gasoline, containing possibly 100 or more hydrocarbons, the change in volatility with percentage evaporated is very marked; hence, with gasolines and similar fuels, the conditions under which volatility is measured must be specified.



Wiring diagram showing the electrical connections of Bridgeman's spark accelerometer

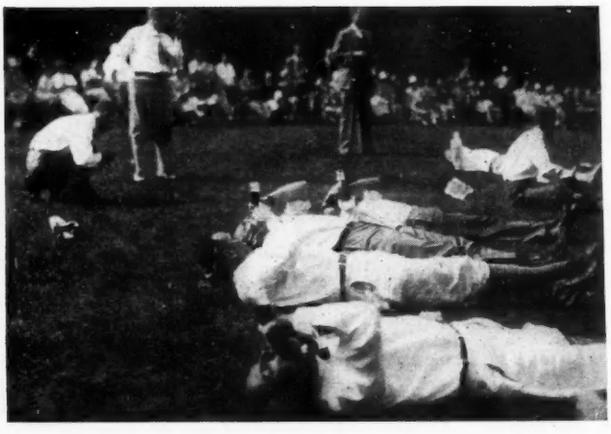
"In all of the work reported, the volatility of a fuel is represented by the temperature at which a given air-vapor mixture will be formed under equilibrium conditions, at a pressure of one atmosphere, from any mixture of liquid fuel and air supplied, when a given percentage is evaporated. A 16-1 air-vapor mixture is used exclusively as a standard of reference in this report, since it is about the leanest mixture which it is feasible to employ in the engine. Values for other mixtures may readily be obtained from the temperatures corresponding to 16-1 mixtures. In accordance with previous usage, the temperature at 0 per cent evaporated is called the bubble-point and at 100 per cent evaporated the dew-point. At each intermediate percentage on any air-vapor curve, there will be a corresponding temperature.

"All of the volatility data apply to equilibrium conditions and as such are functions only of the thermodynamic systems being investigated, being independent of the apparatus used. Under these conditions of equilibrium vaporization, if the composition of all of the fuels investigated were known, an extensive theoretical correlation of the data would be possible on the basis of the relations deduced by Willard Gibbs in 1876. Almost all of our present knowledge of the scientific principles underlying equilibrium vaporization is due to his work.

"Since it is almost hopeless to attempt the analysis of any gasoline other than the very volatile natural gasolines of comparatively simple composition, the assumption was made that the A.S.T.M. distillation curves of the gasolines were sufficiently characteristic to make unnecessary any specific knowledge of the composition. For this reason, all of the volatility data were referred to appropriate A.S.T.M. temperatures, leading to remarkably consistent relations and verifying the rationality of the above-mentioned assumption. The bubble-points were found to be related to the A.S.T.M. 10 per cent temperatures and the dew-points to the A.S.T.M. 90 per cent temperatures. At each intermediate percentage evaporated, from 10 to 90 per cent, the equilibrium-air-distillation data were related to the corresponding A.S.T.M. points. In these relations high accuracy was obtained by taking into consideration the effects of temperature and the slope of the A.S.T.M. curve on the values of the ratio T_{astm}/T_{ead} (equilibrium air-distillation), and by correcting all A.S.T.M. temperatures for distillation loss."

Mr. Brooks described an improved form of the spark accelerometer which he has been using in studying the effect of fuel characteristics on the acceleration of engines. So far, all of these tests have been made on a single engine. It was shown in a report presented at the annual meeting in Detroit last winter that the A.S.T.M. distillation curves of three fuels tested bear a close relationship to the starting characteristics of engines using these fuels. It has now become desirable to apply the test to other engines so as to eliminate the factor of peculiarity of engine design. To this end, a portable spark accelerometer has been designed, which also is more readily adapted to engines of different designs.

The method employed in determining the acceleration of the engine consists in driving a paper tape at a speed proportional to the engine speed and discharging a spark through it at equal time intervals. Equal time intervals are assured by producing the sparks by means of an interrupter operated by a tuning fork. A displacement-time record is thus obtained, the second derivative of which is the acceleration. The new instrument is to be used on 10 different engines, at different laboratories.



The prohibition race, pictured herewith, was one of the popular events at the field day held during the Summer Meeting of the S.A.E.

Special *Service* Vehicles *Considered* by *Motor* Truck Design *Conference*

Their application to telephone line construction is related in detail. Power take-offs, trailer hitches, cranes, winches and similar devices are discussed.

AN animated discussion of the relative advisability of using standard trucks with special equipment or special trucks built to suit the specific need for non-transportation use featured the Motor Truck Design Conference. Only one paper was presented. It was entitled "Extending the Use of Motor Vehicles Beyond the Field of Transportation" and was presented by T. C. Smith of the American Telephone & Telegraph Co. A motion picture showing two and four-wheel trailers in operation was projected by H. W. Raymond, of the Lapeer Trailer Co.

Those on the program at the Motor Truck Design Conference were, left to right: F. K. Glynn, T. C. Smith, of the American Telephone and Telegraph Co., and H. W. Raymond

Mr. Smith's paper naturally dealt mainly with the work in the field of the A. T. & T., such as the erection of telegraph and telephone poles, and lines, but also included a discussion of many varieties of special equipment which have been developed specifically for mounting on motor trucks, and operation by engine power, including hole diggers, hoists, reels, etc.

"Machine tools are sold on the basis of the development by the sales agency of special auxiliary devices," stated Arthur W. S. Herrington in discussing Mr. Smith's paper. "Why should the same not be made true also for trucks?" Continuing, he pointed out the many fields where motor trucks are needed for other than transportation purposes, such as in oil fields, at airports, etc.

To these, Ralph Baggaley, Jr., of the Pennsylvania Department of Highways, added trucks on which are mounted snow plows, stating that cooperation is badly needed between the manufacturers of trucks and plows. M. C. Horine, International Motor Co., while admitting the great need for trucks for special applications, stated that in his opinion it would be relatively impossible to develop a single chassis that would meet all the varied needs, and that this would involve a radical redesigning of existing units. As a suggestion, he offered the possibility of installing a power take-off below the driver's seat, deriving its power from the transmission tail shaft. To this, Mr. Smith replied that they already had in operation 50 such trucks.

F. C. Horner, of the General Motors Corp., also thought that it would be more economical to use a standard truck chassis, with special equipment, due to the lower production cost possible. Mr. Horner revived the question of standardizing on trailer hitches. In answer to a further question by Mr. Horner as to the advantage in carrying a removable crawler track on one of the A. T. & T. trucks, Mr. Smith stated that they found crawler tracks necessary in some of their right-of-way work, and that tractors were too slow, trucks with quick installable tracks having a 50 per cent to 100 per cent higher speed under such conditions. "With this installation," Mr. Smith continued, "our greatest problem was that of steering. We are now working on a satisfactory method of locking one of the tracks so as to apply full power to the other for turning."

Mr. Smith also thought that the lack of standardization up to now on trailer hitches is because of a fundamental difficulty. "We have found the Government or Army type of hook rather satisfactory," stated Mr. Smith, "except where heavy hauling is involved. With the latter type of operation, we have to replace sometimes as many as one a day. We hope for one thing to design also a hook with a true universal action."

To this Mr. Herrington added that the Ordnance hook also was unsatisfactory for high speed operation, or upward of 25 m.p.h. Moreover, he said, the trailer hook should have the qualifications for being "universal," should have its lubricating system self-contained, and must be easy to hook.

On the question of standardization of trailer hooks, W. J. Retzlaff, of the Fruehauf Trailer Co., said that they had found it essential to have several different hooks for different applications.

Both Mr. Horner and Arthur J. Scaife, White Motor Co., thought that the fundamental problem was one of patents, and that a cross licensing arrangement, similar to that between automobile manufacturers, might offer a solution. A resolution was then introduced by Mr. Herrington requesting the responsible S.A.E. subcommittee to expedite work on the question of standardization of such a unit. It was pointed out, however, that the S.A.E. is not a designing body and that in the past it has been shown that when S.A.E. standards were established for parts not in actual use, that they were disregarded almost completely.

Adding concrete mixers to the list of special truck applications already mentioned, Mr. Scaife said that there also the patent situation was the vital drawback which prevents the interchangeable use of different manufacturers' equipment, with the added handicap entailed by the giving of exclusive rights to contractors in different localities by concrete mixer manufacturers.

As a basis for a general utility truck for special application, Mr. Scaife suggested a more or less standard engine, a transmission with three power take-offs, one on each side, and one below, and an axle with a housing large enough to accommodate a wide range of gear ratios. In answer to a suggestion that the state highway departments take over "emergency road work," for clearing highways of stalled or wrecked vehicles, etc., Mr. Baggaley stated that the handling of highway obstruction removal was only possible on highly concentrated routes, and that for other conditions, the commercial organization is capable of giving a much quicker service, due to time lost in notifying the proper highway department superintendent, etc.

Following the presentation of the motion picture of trailer truck operation, Mr. Retzlaff and Mr. Horner argued the relative cost of trailer truck and railroad freight operation. Mr. Retzlaff had stated trailers are a help to truck manufacturers, rather than the opposite, especially in meeting railroad competition on distances of up to 400 miles. He offered a number of examples of present-day operation of such transportation of general merchandise in competition with railroads. However, Mr. Retzlaff was unable to furnish actual cost figures as the operations were conducted not by the firms themselves but by outside contractors. One line, he said, with 5-ton tractor trucks hauling a 20-ton payload, has been in operation one year and has shown a direct labor cost of about five cents per ton-mile.

A point Mr. Retzlaff made, and which was supported by others, was the time saving possible with truck trailer shipment over that with railroad freight.

Extending Truck Usage

An abstract of Mr. Smith's paper follows:

Mr. Smith described a number of power devices driven from the engine, the transmission and the propeller shaft of motor vehicles. He stated that the propeller shaft power take-off is the most suitable for general use, as it is so arranged that power can be obtained from the vehicle engine through any of the transmission gears in both the forward and the reverse direction. Ordinarily, when the power take-off is in operation, the clutch, which is a part of it and which operates the propeller shaft to the rear, is disengaged. However, the design is such that, when desired, both the truck and the power take-off can be operated simultaneously. The chain drive can be taken from either the front or the rear of the case and from either side of the propeller shaft, and units of this type have been made with two take-off shafts.

The S.A.E. power take-off opening on the side of the transmission is employed in some cases. However, it has been found generally that, in driving the heavier equipment, this take-off is not sufficiently flexible, as the power is taken from the lay-shaft in the transmission and the various transmission speeds are not available in the takeoff. Because of this and to provide some flexibility of operation, a special auxiliary transmission which gives two forward and one reverse speed has been designed to fit over the S.A.E. power take-off opening. Because of the small size of the standard S.A.E. opening, it is necessary first to bolt an adapter plate to the transmission and then bolt the take-off to the adapter plate.

Even the large S.A.E. opening is much too small for many purposes, the author maintained, but he believes that a poor standard is better than no standard.

Winches are Important

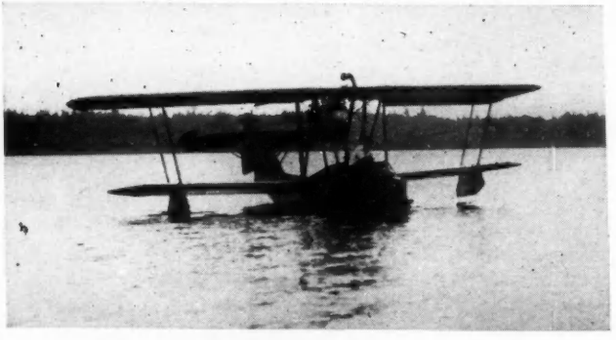
One of the most important power devices used in the public utility field is the winch. The winches developed for such work as telephone line construction are made of steel, and a unit that will accommodate 1000 ft. of 7/16-in. rope weighs about 500 lb.

A satisfactory winch mounting is provided by castings bolted or riveted to the truck chassis frame. The winch is set on these castings and secured to them with four heavy bolts. While the worm and wheel operating the winch are so designed as to be practically irreversible, owing to the inertia parts, the load continues to lower slowly after the clutch is released, unless there is a clutch brake. For use on trucks having no clutch brake, an automatic brake has been designed, which is incorporated in an idler sprocket. These winches are now generally being driven by silent chains, quite high chain speeds being required. The rope speeds required in telephone work vary from 50 to 300 ft. per minute.

Whenever a heavy handling job arises in telephone work, the first thought is to make some adaptation whereby the work can be done with truck equipment. For instance, when 5-ton reels of cable must be unloaded from cars at railroad slidings, with all work done from one side of the freight car, a framework with suitable tackle is attached to the rail, so that the winch line can be led under the car and up on the side opposite from the truck. The end of the line is attached to a yoke that holds back on the reel as it is lowered to the ground over heavy skids.

The Bell system sets more than a million telephone poles per year. These weigh from 1000 to 3000 lb. each and are hard to set by hand work but can be readily set by means of derricks on motor trucks. A pole can be stopped at any desired point in the process of raising it by merely throwing out the engine clutch.

Poles are transported from the railroad yard or the pole yard to the job by means of suitable trailers. Two-wheel trailers are used mostly, the poles being substantially balanced on them, but occasionally the poles are transported by means of four-wheel trailers. Another heavy handling job in telephone work is encountered in loading coils in heavy iron cases, which resemble electric power



The Curtiss flying boat in which Coker F. Clarkson, secretary and general manager of the Society of Automotive Engineers, flew part way to the session from New York City. Fog made it necessary for him to complete the journey otherwise. The Curtiss plane arrived later, however, and took a number of those attending the Summer Meeting for rides

transformers. Special derrick equipment has been designed for lifting these cases to any desired position on the truck platform and unloading them by reversing the operation. The truck upon which this derrick is mounted carries removable tracks by means of which it can traverse practically any right-of-way where a crawler tractor can operate.

The large reels of cable used in telephone work are transported on trucks or trailers, and wherever practical they are loaded by being drawn up directly over the rear of the truck platform without the use of skids.

Power from the engines of motor trucks is used also in telephone service to spray heated creosote on portions of telephone poles just below the ground, after they have been uncovered and freed of decayed wood, and for operating earth-boring machines.

Inequality In Apportionment of Gas Due to Air Horn

(Continued from page 17)

manifold pressure at idling.

E. D. Herrick said that in order to effect correct distribution of the charge, the latter must be in the proper state when it enters the manifold. There must be no large particles of unvaporized fuel in it, and this can be assured best by seeing to it that the proper temperature is maintained in the manifold. He had found that if the manifold temperature was maintained at 120 deg. F., satisfactory distribution was possible. It was also necessary to have symmetrical flow of the charge through the riser, as otherwise the division of the charge between the front and rear parts of the manifold was likely to be unequal.

A paper on "The Effect of a Centrifugal Supercharger on Fuel Vaporization" was read by C. Fayette Taylor, associate professor, Massachusetts Institute of Technology. Manufacturers of superchargers have claimed that these devices considerably improve the condition of the fuel mixture in the cylinder, because of the churning and atomizing effect of the high-speed centrifugal supercharger, and the tests were made evidently, to check upon those claims.

A Chrysler 70 engine was used in the tests. The exhaust-heating jacket was removed from the inlet pipe and two carburetors were connected to the inlet manifold through gate valves, one directly and the other through a centrifugal supercharger. The object was to determine only the effect of the mechanical agitation of the supercharger on the fuel mixture, and since the supercharger normally also increases the inlet pressure and the temperature of the incoming charge, these two effects had to be compensated for.

The following conclusions were drawn:

The mechanical-mixing effect of this particular type of high-speed centrifugal blower, located between the carburetor and inlet manifold of a normal automobile engine, with unheated inlet manifold, has the following effects on engine performance:

1. At or near normal full load at all mixture ratios for smooth engine operation. (a) An increase in brake mean effective pressure. (b) A decrease in specific fuel consumption. (c) A slight increase in the range of mixture ratios for satisfactory engine operation.
2. No improvement at part load, at least at three-quarter load and below, when using commercial gasoline. This might be accounted for by supposing that, with the high mixture temperatures used in these tests, evaporation of the fuel at part load without the blower was sufficiently complete so that no appreciable improvement was possible.
3. At full load the tendency toward an increase in maximum brake mean effective pressure, a reduction in fuel consumption and an increase in the firing range with increasing blower speed is definite.
4. The improvement to be noted at full load is more pronounced with a less volatile fuel.

An exhaustive study of the problem of fuel utilization in automotive engines is being made at Massachusetts Institute of Technology, and one phase of this, relating to manifold design, was discussed in a paper by Charles Louis Petze, Jr., The investigation was carried out on a large, heavy-duty six-cylinder engine. The brake horsepower, torque, brake mean effective pressure, specific fuel consumption and thermal efficiency were determined for seven-eighths throttle and over a speed range of 800 to 1200 r.p.m., and the results were given in a graph accompanying the paper.

By means of exhaust gas analysis the air-fuel ratio and the degree of completeness of combustion were determined for the same operating conditions. The air-fuel ratio varied from about 13.2:1 at 825 r.p.m. substantially uniformly to 13.6:1 at 1245 r.p.m., this decrease in richness of mixture with speed evidently being a characteristic of the carburetor used.

The completeness of combustion was lowest at the minimum speed, about 87 per cent; stood at 90 per cent over most of the speed range, and rose to 91 per cent, or a little over, at the maximum speed. That not all of the fuel could be burned is obvious, for at no time was the proportion of air to fuel sufficiently large to consume all of the fuel, the latter being of such composition that a ratio of 15.58 was required.

By exhaust-gas analysis, the air-fuel ratio of the mixture supplied to each cylinder also was determined for various points of the speed range, and the results are given in Fig. 3 (page 17). In discussing results Mr. Petze said:

"The center cylinders receive much richer mixtures than the end cylinders at the lower speeds, but the magnitude of the differences gradually lessens as the speed increases. It can scarcely be believed that the mixture in the riser is in the form of a true gas or vapor (which terms are synonymous), and the more logical view that the gasoline is present in the air as a collection of fine particles of liquor, held more or less in suspension by the air, will be taken. These particles, fine though they are, being possessed of a greater density than the air, will tend to settle out of the air; they will be restrained from doing so only if the strength of the air-film on which each particle rests is sufficient to avoid rupture. This, then, is the first condition of proper distribution; the particles of fuel must be restrained from settling out of the air of the mixture.

"Summarizing, the first step is to obtain the finest possible particles of gasoline. Second, these particles must be mixed intimately with and distributed evenly throughout the body of air supplied. Third, the air must be moving with sufficient velocity to retain the gasoline particles in suspension. If these points are observed to the limit, the first stage necessary to proper distribution will have been attained."

First with the News

Reliable, Accurate

News of the Industry

PAGE 28 VOLUME 61 *Philadelphia, Saturday, July 6, 1929* NUMBER 1

High Third Quarter Output Is Forecast in the Industry

PHILADELPHIA, July 6—Closing its books on the greatest first half-year's business of its history, the automotive industry has entered the third-quarter with every indication that business will continue at a high rate. There are many motor car leaders who have made a careful analysis of the market who predict that the third-quarter will likewise set an all-time production mark when compared with the third-quarter of other years. Sales executives indicate that the demand for new cars is becoming more evenly distributed throughout the country.

New car stocks, which were built up as a result of the record output, appear to have reached the peak at the start of the spring selling season, and, with a strong retail demand continuing, the number of cars in the field has been gradually reduced as the season progressed. Indications are that there is an increase in new car stocks in the field other than Ford, but the increase is so close to the retail demand that the situation as a whole is not alarming.

As in former years, many manufacturers will start to reduce production during July. Manufacturers who are preparing new models for introduction will operate at a high production rate, which will have a tendency to stabilize the production figure of the industry as a whole on a high plane.

Dealers and distributors have given more attention this year than ever before to moving used car stocks, and reports indicate that used cars have been moving at a ratio in keeping with new car movements, with the result

(Continued on page 30)

Houdaille-Hershey Reports

DETROIT, July 2—Net earnings of the Houdaille-Hershey Corp. for the first five months of 1929, after giving effect to the combination with General Spring Bumper, are reported as $3.43 per share on the Class B stock after all charges including taxes and allowances for Class A dividends for the same period.

Graham Denies Report

DETROIT, July 3—Robert C. Graham, vice-president of the Graham-Paige Motors Corp., stated yesterday that there was absolutely no foundation to the report that he was seeking a plant site in Constantinople during his recent trip abroad.

Change in Ruxton Plans Indicated by Roberts

NEW YORK, July 3—New Era Motors, Inc., manufacturer of the Ruxton front-wheel drive car, has leased temporarily, quarters in a large, fully equipped automobile plant in St. Louis, where it will assemble finished cars until it can complete and move into a plant of its own in Detroit, according to announcement made today by J. E. Roberts, recently appointed general manager. Plans announced some time ago for assembly of the car in a plant in Cleveland as well as in St. Louis have been abandoned, it being Mr. Roberts' opinion that the work can be carried on more efficiently in one plant.

Ainsworth Adding Unit

DETROIT, July 1—It is understood that negotiations have been completed for the purchase by Ainsworth Mfg. Corp. of the Joseph N. Smith Co. Both companies make automotive parts. Stockholders of Ainsworth are to be given the right to subscribe at $40 per share to one share of Ainsworth for each five shares held. Rights will be to stock of record July 9, and must be exercised upon before July 25.

Sterling Succeeds Oosdyk

DETROIT, July 3—C. D. Sterling has been named director of purchasing of the Hudson Motor Car Co., succeeding C. A. Oosdyk, whose resignation was announced last week. Mr. Sterling has been with Hudson since 1916, in the cost and purchasing departments. Since May 1 he has been first assistant secretary of the company.

Automotive Leaders Invited to Capital

WASHINGTON, July 3—In connection with a proposal to transfer automobiles from the protected to the free list in the tariff revision now being considered by the Senate Committee on Finance, a number of leaders in the automobile industry have been requested to appear before the sub-committee on metals Thursday, July 11, by Senator Reed of Pennsylvania, chairman. Under existing law, automobiles carry a 25 per cent ad valorem duty, which many leaders of the industry are said to believe should be eliminated or reduced. Those to whom invitations were sent include: Henry Ford, Alfred P. Sloan, Jr., president of the General Motors Corp.; Alvan Macauley, president of the National Automobile Chamber of Commerce, and of the Packard Motor Car Co., and W. C. White, president of the White Motor Co.

National Credit Group Forms Automotive Unit

MINNEAPOLIS, July 2—In recognition of the importance and growth of the automotive industry a separate group has been formed by the National Association of Credit Men. Heretofore this section has been grouped with the implement and hardware trade. The first group meeting was held at the thirty-fourth annual meeting of the National Association of Credit Men June 24-28 in Minneapolis.

Bendix Acquires Pioneer

NEW YORK, July 2—The Bendix Aviation Corp. has acquired by purchase the Pioneer Instrument Co. of Brooklyn. Vincent Bendix, president, has announced that the purchase will be concluded by an exchange of stock and that Charles H. Colvin, general manager of Pioneer, will be a director on the board of Bendix. The Pioneer company is expanding its factory and within a few months will occupy more than 60,000 sq. ft. of floor space. This company is 10 years old.

Henry is Reelected President of A.A.A.

BUFFALO, N. Y., July 3—Thomas P. Henry, of Detroit, was reelected president of the American Automobile Association for the seventh consecutive year here yesterday at the closing session of the 27th annual convention of the association. Charles C. Janes of Columbus, Ohio, and George W. White of Washington were reelected secretary and treasurer respectively.

Charles M. Hayes, Chicago; S. Edward Gable, Lancaster, Pa.; A. E. Mittendorf, Cincinnati; Owen B. Augsburger, Buffalo; Perley M. Ripley, South Paris, Me.; Robert C. Haldeman, Harrisburg, Pa., and John H. Wright, Jamestown, N. Y., were elected vice-presidents by acclamation.

The executive committee of the association will include Owen B. Augsburger, Buffalo; W. E. Mittendorf, Cincinnati; Roy F. Britton. St. Louis; Arthur M. Hill, Charleston, W. Va.; Robert P. Hooper, Philadelphia; William E. Metzger, Detroit; Charles M. Hayes, Chicago, and Percy E. Towne, San Francisco.

During the two-day convention the association decided to take action in eradicating the practice of some states of diverting the money received through gasoline taxes into channels other than those from which the motorist derives direct benefit. The "short measure" tactics of some gasoline vendors were also condemned, and the convention passed a resolution to request that the weights and measures laws be more strictly enforced.

The members went on record as strongly favoring an increase in the annual forest road appropriation of from $7,500,000 to $12,500,000. Announcement was made that plans are now under way to have the association bureaus give service on air and water as well as land transportation.

Wright Adding Capacity

NEW YORK, July 2—The Wright Aeronautical Corp. is breaking ground for a plant addition, which will give it 50,000 sq. ft. additional floor space. This will allow for employment of about 500 more men and will enable the company to increase its production to about 1000 engines a month as compared with its present output of 300 a month. It is expected that this will be ready for occupancy in about five or six months. By that time the company will be in production on its recently acquired Gypsy engine in addition to all its present models.

Polish Firm Announced

WASHINGTON, July 3—At a recent meeting of the Polish Czeakomorawskie Kolben-Danek Co. it was decided to establish a new automobile factory in Poland, according to a report received from Warsaw by the Commerce Department this week. Sixty-five per cent of the capital stock of the company—2,000,000 zlotys—is in the hands of the Kolben-Danek Co., 17.5 per cent has been bought by Count Roger Raczynski of Regala, and 17.5 per cent belongs to Count Arthur Potocki of Krzeszowice. The company will have headquarters in Krakow. Count Raczynski has been appointed president and Dr. Kolben vice-president.

Nash Adds Coupe

KENOSHA, WIS., July 3—The Nash Motors Co., has added a 2-4 passenger coupe to its Standard Six line at $935.

Reports from the Factories for June

Among the makes of cars on which June production reports were not received as this issue of *Automotive Industries* went to press are: Ford, Durant, Oakland, Peerless, Pierce-Arrow, Studebaker and Gardner.

Auburn Automobile Co. sold 3144 cars, compared with 3039 in May and 1402 in June, 1928, according to N. E. McDarby, director of sales. Sales during the first six months of this year totaled 14,626 cars, compared with 13,481 in the entire year of 1928, an increase of 8½ per cent, Mr. McDarby explained. The company contemplates the production of 2500 cars in July, and expects the second half to equal or exceed the first.

Franklin Automobile Co. reports shipments for the first six months of the year of 8719 cars, exceeding shipments of 3711 cars shipped in the corresponding period last year by 135 per cent, and establishing a new all-time shipping record in the company's history. The previous high record for shipments within six months was 7064 cars. Shipments last month totaled 1405 cars, compared with 806 cars in June, 1928.

Hudson Motor Car Co. turned out 31,737 Hudson and Essex cars, exceeding by a wide margin the best previous mark for June, made last year. Production for the first six months of the year is brought to 226,318 units, compared with 183,047 in the first six months of 1928, a gain of 24.2 per cent.

Graham-Paige Motors Corp. produced 5987 cars last month, bringing the total for the first six months of the year to 54,498 cars, compared with 38,739 in the same period last year, a gain of more than 40 per cent.

Marmon Motor Car Co. shipments last month exceeded those of June, 1928, by 104.5 per cent, according to G. M. Williams, president. Shipments for June, last year, were shown as approximately 1300 cars.

Hupp Motor Car Corp. reports the production of 2030 cars of which 56 were shipped to Canada and 322 for export. The company announced shipments for May of 5329 cars.

Packard Motor Car Co. announces production for the first ten months of its fiscal year, ending June 30, totaling 46,702 cars.

Chrysler Motors reports shipments for all its divisions as 42,351 vehicles, compared with 26,820 for combined Chrysler and Dodge shipments in June, 1928. The corporation's shipments for the first half of 1929 totaled 279,635 units, an increase of 53,354, or 23.5 per cent above the 226,281 units shipped by Chrysler and Dodge during the first half of 1928. The Plymouth line showed the most pronounced gain, exceeding its June, 1928, record by 282 per cent, with shipments of 13,763, bringing its total for the six months to 70,022.

Olds Motor Works reports an increase in production and shipments during the first six months of 1929 of 34.6 per cent over the corresponding period of 1928, setting a new all-time record for Oldsmobile for that period. From Jan. 1 to June 30, inclusive, the company produced 67,389 cars compared with 50,070 Oldsmobiles shipped during the first six months of last year.

Chevrolet Motor Co. produced 151,297 units, compared with 132,800 in June, 1928, the best previous June in the company's history. To date Chevrolet has built 845,469 of the six-cylinder models compared with 751,542 produced during the first six months of 1928. While no official statement was issued, it is understood that the company will continue July production on practically the same basis as that of June.

Nash Motors Co. shipments of cars in the "400" series in the first six months of 1929 showed a gain of 57 per cent over those of the same period last year, according to C. H. Bliss, general sales manager. During June 9070 units left the company's plant, bringing the six months' shipping total to 76,700 cars.

Buick Motor Co. announces the production of 10,400 Marquette and 4265 Buick automobiles, a total of 14,665 units. The schedule for July calls for an output of 8000 Marquette and 23,408 Buick cars.

Willys-Overland Co. sales totaled 26,000, according to preliminary reports. This compares with 31,000 in May. A production schedule of 25,000 or more has been set up for July.

Reo Motor Car Co. reports the production of 3042 units in June, of which 1372 were passenger cars and 1670 were speed wagons. The company reported its production for May as 4463 units.

Cadillac Motor Car Co. reports that shipments of Cadillac and La Salle cars during the first six months of 1929 were brought to a total of 19,512 units.

Completing Spicer Unit

TOLEDO, July 3—The large addition to the plant of the Spicer Mfg. Co., in this city, will be completed about Aug. 1, according to R. E. Carpenter, vice-president and general sales manager. The addition will double the size of the plant, giving it 400,000 sq. ft. of floor space. Charles A. Dana, president of the company, left a few days ago to visit the plant at Birmingham, England. He will visit France also to consider the possibility of opening a branch plant in that country, it was explained here.

Outlook for Third Quarter is Favorable

(Continued from page 28)

that, while there are large numbers of used cars on hand, the condition is not causing the alarm that it has in previous years. Reports from several of the leading centers on sales in June and the outlook for the third-quarter of the year follow:

New York City

Sales of new cars in and around Manhattan are running 15 to 20 per cent ahead of last year at this time. In many instances stocks, particularly of certain models, are extremely limited, dealers in the lower and middle priced field having no cars of certain models on their floors. Demand runs pretty generally. Weather throughout June has been highly favorable to the sale of cars and is responsible for considerable increase over the previous two months when the weather was generally adverse to sales. Sales of Fords are running slightly ahead of Chevrolets, although buyers of both lines are frequently having to wait for deliveries. In very few instances are used car stocks at all oppressive. There has also been an active demand for used cars which has helped the dealers to keep their stocks of this class of merchandise fairly well cleaned up. New car registrations in New York City during the first week of June were 4351, according to Sherlock & Arnold, and compare with 3727 for the corresponding week of last year.

Philadelphia

In the face of two consecutive weeks of bad weather at the beginning of June, new car sales for the month generally showed a slight drop from the preceding month, and are slightly ahead of June last year. In the top price group Packard sales were about 30 per cent ahead of May, with other makes following the general trend. In the middle priced group about half the distributors reported a slight drop in June sales compared with May, and the other half a slight gain. A number of Ford dealers reported that June was the best month they have ever had. New car stocks are generally reported favorable, and the used car situation is generally good, with stocks in some cases below normal.

Chicago

Sales of new cars in June stayed approximately at the same level as in May, which fell about 5 per cent below the April peak. Sales, however, were about 10 per cent ahead of June last year. New car stocks are somewhat greater than May while used car stocks remain at about the same level as the previous month. Low-priced groups still sell at about 50 per cent of the total volume, while medium priced lines are moving at about 35 per cent. Dealers feel confident that sales in the third quarter will maintain the gain over last year that has been evidenced thus far.

Cleveland

Despite the seasonal slowing down, new car sales for June were greater than the corresponding month in 1928. Business in used cars showed a marked increase. Stocks, both new and used, while fairly heavy, are not regarded as overly large. Anticipations for summer sales point to a higher total than that reached in the third quarter last year. Ford continues to set the pace, leading Chevrolet by a fair margin.

Milwaukee

Dealers are entering the third quarter with good prospects for continued active demand, and with new car stocks in a favorable position. Practically all groups have enjoyed good business during the first half, and new car registrations for the state of Wisconsin as a whole show an increase of about 40 per cent over the same period last year. May, which always is the peak month in passenger car deliveries in Wisconsin, produced 19,858 new registrations, compared with 12,795 a year ago, representing a gain of 55 per cent. June is well ahead of last year. Used cars have accumulated with the heavy sale of new cars, but the situation is in nowise considered alarming. Chevrolet sales are maintaining a fair percentage of increase over a year ago, and Ford dealers still are unable to make prompt delivery of certain types. Weather conditions in June were the most seasonal of any month this year.

Minneapolis

The outlook for business for the third quarter is good. In Minnesota the half year payment on licenses has been advanced from August 1 to July 1. The result will be that purchasers who usually wait to save a half year license fee will close their deals. The used car market is bothering; stocks are larger than last year, although stocks of new cars are not larger in the district, apparently. An expert put the increase in automobile sales in the Northwest about 24 per cent above last year but this would be cut down when averaged, as many of the new registrations show increase in Ford sales over last year. High-price and low-price cars continue to hold the field, Ford leading. Of deliveries of 2069 cars to date in the largest county, 845 were Ford and 254 Chevrolet cars. In trucks 62 of 157 were Ford and 43 Chevrolet vehicles.

Cincinnati

June new sales were 2.6 per cent under May, while decrease in used cars was but .6 per cent. Increase over June last year in new and used cars is 51 and 19 per cent. New car stocks are 20 per cent lower than last month, but used inventory slightly higher. New and used car stocks 35 and 18 per cent under last June. High priced cars accounted for 4 per cent of June sales; medium priced, 17, and low, 79. Ford sales were 105 per cent greater than Chevrolet and 465 per cent over next highest competitor (Essex). Third quarter sales situation looks good.

Denver

With the advent of good weather, car sales in city showed a marked improvement in all lines for June, both as compared with June, 1928, and with May, 1929. Country business is still badly depressed owing to crop failures and ruinously low prices on crops that did mature. Used car stocks are generally high. Low and high priced cars seem to be most active, with less gains in the medium priced ones. In June in Denver county Ford showed 51 per cent of all car registrations, with Chevrolet second in about the proportion of one to three and one-half, and Essex was third with about one-half that of Chevrolet. The same figures obtain in a general way throughout the territory, except that Whippet seems to replace Essex for third place. Whippet seems to be strongest in gains over a year ago, with the exception, of course, of Ford, which was not in production a year ago.

Seattle

While retail car sales last month were approximately 15 per cent above sales for May, they held about even with sales for June, 1928. Sales for second quarter 10 per cent off as compared with same period of 1928, and same holds true for business for first six months of this year. Stocks at present time heavy, with sales not yet hitting pace. Sales in high-priced group have fallen off 20 per cent, in medium group 10 per cent, while the low-priced group has shown a gain. Decrease is attributed for the most part to unfavorable climatic conditions, weather continuing cold and rainy beyond middle of June. Ford is still outselling all his competitors, and able at all times to make deliveries. The used car market is in much better shape than in May.

St. Louis

June sales were normal and showed an increase of 35 per cent over May. Almost continuous rain in May seriously curtailed sales. With better weather, country business has opened up and an excellent month in July is foreseen. Stocks of new cars are full, but are being reduced. Used car stocks, due to the decreased new car business in May, are 25 per cent less than on May 1. Accessories have shown excellent gains.

New Orleans

New and used stocks are normal. June deliveries average 3 per cent above May but possibly 20 per cent below last June. Business for first six months is possibly 20 per cent less than first half of last year. Sales continue rather dull except low priced field. Thirty-three per cent of all June deliveries were Ford cars leading Chevrolet cars by 40 per cent. Dealers predict increased business third quarter.

Dallas

The outlook for the third quarter is good, dealers and jobbers throughout Texas say. At the close of the half new car sales showed an increase of 6 per cent over same period last year while stocks were 5 per cent lighter. Low priced cars held 60 per cent sales in first six months, medium priced 25 per cent. Ford and Chevrolet running neck and neck. Essex next in rank. Used car sales heavier and stocks lighter than same period last year.

Kansas City

Kansas City dealers are not greatly overstocked on new cars. Sales held up well enough in June to keep stocks normal. Sales for month probably were 10 to 15

(Continued on next page)

Mills Enter Quarter With Aspect Normal

Speeding of Steel Shipments is Noted at Close of First Half

NEW YORK, July 3—The more leisurely pace which characterizes steel mill operations as well as fresh demand emphasizes the perfectly normal aspect of the steel market at the opening of the year's second half. Mills are shortening more and more the interval between receipt of specifications and shipments.

The question uppermost in the minds of producers is when the next heavy buying movement will materialize. Last year the leading interest recorded an increase in bookings over shipments in August, September and October, its unfilled tonnage at the end of the third quarter being virtually unchanged from its backlog at the end of the second quarter. The real heavy increment in orders usually comes in December.

A good demand for sheets is noted from manufacturers of low-priced passenger cars. Strip mills are operating at an excellent rate for July. Manufacturers of automotive alloy steels and cold-finished bars have a good run of routine business. Prices hold steady all along the line with the exception of black-sheets in which some transactions at below 2.85c, Pittsburgh, are occasionally rumored. To what extent the Interstate Commerce Commission's order on freight rates in central classification territory will affect competitive conditions in the steel market remains to be seen.

Pig Iron—Fairly active market conditions are reported from Detroit and other Middle West consuming markets. While automotive foundries are taking less iron, builders of machine tools for the automotive industry require heavier tonnages for their foundries. Quotably all markets are unchanged.

Aluminum—The market is unchanged, with the demand from automotive consumers rather quiet. European advices point out that Continental members of the aluminum cartel espouse a continuance of the policy of lowering prices for the metal, so as to gain for it steadily growing application as a substitute for copper, but that British producers hold to the opinion that aluminum should reap the full benefit of advances in the copper market, just as it is adversely affected when the market for that metal is subnormally low.

Copper—While the export market has been fairly animated, domestic consumers have been rather slow in taking hold. Prices remain unchanged.

Tin—Steadiness is in evidence. For the time being, the more ambitious plans to lift the metal to much higher prices appear to have been shelved.

Lead—Fair demand from storage battery manufacturers is noted.

Keys Explains Purpose of Curtiss-Wright Corp.

NEW YORK, July 3—Clement M. Keys, head of the various Curtiss-Keys interests and president of the recently organized Curtiss-Wright Corp., sailed last week for Amsterdam where he will represent the American aviation industry at the International Chamber of Commerce. Before leaving he expressed himself as highly optimistic as to the future of the American industry.

In answer to a number of inquiries, Mr. Keys stated that the new company would hold itself entirely aloof from air transport activities, concentrating on the manufacturing end. Although both himself and Richard F. Hoyt, principals in the recent merger, have a number of transport interests, these will be kept entirely separate from the new company, he indicated.

Gardner Proposes Increase in Stock

Issue of 200,000 Shares Considered Necessary to Production Plans

ST. LOUIS, July 1—Plans for the production of a new low-priced automobile to be marketed through Sears, Roebuck & Co., and of the Ruxton front-wheel drive automobile, have made necessary the issue of 200,000 additional shares of capital stock, according to an announcement by R. E. Lynes, assistant secretary of the Gardner Motor Co., Inc. A meeting of the stockholders is to be held on Aug. 1 to vote on the new stock issue proposed by the directors. It is expected that $2,500,000 will be realized by sale of the stock.

Expansion of facilities for the manufacture of airplanes by the Parks Aircraft Co., of this city, a subsidiary of the Gardner company, also will be provided for by the new stock issue. The present line of Gardner automobiles will not be affected by these new developments, according to the company.

Additional factory space will be required, but whether this will be obtained by purchase or by the construction of additions to the present plant has not been determined.

Sterling Shows Gains

MILWAUKEE, WIS., July 1—The Sterling Motor Truck Co., of this city, has reported that its net profit for the first half of its fiscal year, ending April 30, almost equals that of the entire year 1928. The company's deliveries of trucks during March and April successively set new records.

Outlook for Car Sales During Third Quarter is Favorable

(Continued from preceding page)

per cent under last year, largely because of excessive rain. Sales in the medium-price group probably show the greatest decrease with the higher priced cars selling from normal to a five to ten per cent increase. Ford sales maintain a lead with Chevrolet a close second and Whippet third. Used car stocks have been reduced slightly in the last month and most dealers report improvement over year ago.

Boston

Distributors report June business was very good and some of them, believing a seasonal drop would be about due, did not order much for this month and are about cleaned out. Stocks are low compared to a year ago. Heavy advertising and drastic cuts in used car prices plus many open air salesrooms have started moving these vehicles, but there are plenty left, more than a year ago, but fewer than in May. Ford sales keep mounting and other cars in its class are making proportionate gains.

Atlanta

Sales decline steadily in June and new stocks are accumulating. Stocks larger than May but not as heavy as June last year. High priced cars showed increased sales in June over May and also exceeded last June. Medium priced cars about same as last year but slightly less than May. Low priced cars declined considerably in June compared with May but were larger than same month last year. Fords reported better than Chevrolets, both considerably exceeding other makes. Used car stocks heavier than they have ever been. Dealers slashing prices.

Detroit

New car sales continued at a high level in Michigan during June and, while final figures are not yet available, it will not be surprising if the month sets an all-time June sales record. In a majority of cases new car stocks are only slightly above normal. Used car stocks are heavy but a good market exists for these vehicles. Ford, Chevrolet and Essex have been outstanding leaders in Michigan sales this year and reports indicate that stocks in the field of these three makes are at a minimum.

Los Angeles

New car stocks are above normal, due to a decrease in sales during June, amounting to about 1500 units less than the May sales. With three days to be reported, June showed a registration of 7337 cars, compared with a total registration in June, 1928, of 10,593. Sales of Ford, Chevrolet and Essex, for all but the last three days of June, show Ford as having outsold the next two, their totals being 2698, 747 and 447 respectively. Used car stocks have been increasing, mainly because Ford cars are now being sold where previously used cars were selected.

Oakland, Cal.

Northern California sales for June about 10 per cent less than for May. About 15 per cent better than for June, 1928. Sales have increased in low-priced group and decreased in medium and high-priced groups.

Men of the Industry and What They Are Doing

Butler Aircraft Names Its Factory Executives

The Butler Aircraft Corp. here has completed its personnel with the appointment of David C. Wikoff as general manager and Milton C. Bauman as chief engineer. The company now is building a new factory on a 15-acre tract at Kansas City. In the meantime production is going forward at the plant of the Butler Manufacturing Co., of which the aircraft company is a subsidiary.

Mr. Wikoff comes to the organization from Sears, Roebuck & Co. Mr. Bauman formerly was associated with Orville Wright. He has been an aviation engineer since graduation from the University of Michigan several years ago. Waverly M. Stearman is the designer for the Butler company, and Wilton M. Briney is sales manager. The officers include: E. E. Norquist, president; Roy S. Kamp, vice-president; William A. Knott, vice-president; Fred A. Rufi, secretary, and Oscar D. Nelson, treasurer.

Merrick Succeeds Herr

F. A. Merrick, formerly vice-president and general manager of the Westinghouse Electric & Mfg. Co., was elected president of the company at the recent meeting of the board of directors. A. W. Robertson, chairman of the board, announced that the resignation of E. M. Herr, president since 1911, had been accepted in order that he might take an extended vacation, but that Mr. Herr had been elected vice-chairman.

National Acme Names Johnson

Willard A. Johnson has been appointed manager of the eastern office of the National Acme Co., 117 Liberty Street, New York City. Mr. Johnson, who has been with the company for several years, succeeds Harry T. Latto, who resigned recently. An item announcing the appointment in *Automotive Industries* last week appeared by mistake with the name "Anderson" instead of that of Mr. Johnson.

Cord on Safety Committee

E. L. Cord, president of the Auburn Automobile Co., has been named a member of the Grade Crossings and Highway Intersections Committee of the National Safety Conference, which will undertake an investigation of the causes of the 8000 to 9000 fatalities which occur annually at grade crossings and highway intersections.

DePalma Working in Secrecy

Ralph DePalma, veteran race driver and engineer, is in Indianapolis, where he is understood to be working on the development of a supercharger. The plant of the Murdock Pump Co., which has been identified with supercharger construction, is the scene of Mr. DePalma's activities and is being carefully guarded. One report says that the race driver has succeeded in interesting automobile manufacturers in the Murdock supercharger, while another report is to the effect that Mr. DePalma is working on an eight-cylinder Miller race car and has increased its speed to 158 m.p.h.

Wilson Leaves Ford

A. E. Wilson has resigned as general employment manager of the Ford Motor Co. Mr. Wilson was responsible for the hiring of the 135,000 men who are now on Ford's payroll in Detroit. Arnold Miller, who was assistant to Harry H. Bennett, in charge of the Ford service department, has been placed in charge of all employment for the Rouge and Lincoln plants, where 110,000 men are working. D. Brown, who formerly was an assistant employment manager, has been placed in charge of employment at the Highland Park plant, which has 22,000 workers.

Willys Expresses Optimism

John N. Willys, president of the Willys-Overland Co., returned to Toledo a few days ago following a six weeks' trip in Europe. On the return voyage he was accompanied by Sir William Letts, managing director of Willys-Overland Crossley, Ltd., of Manchester, England. Mr. Willys said that 1929 automotive exports from the United States were likely to exceed $700,000,000 in value, as compared with exports of slightly more than $500,000,000 in 1928.

McIlroy Appoints Perkins

A. L. Perkins, vice-president of the New England Auto Products Co., a division of the D. K. Bullens Co., Pottstown, Pa., has been appointed by W. E. McIlroy, president of the National Standard Parts Association, to serve on the Merchandising and Standardization Committee of the association, succeeding C. M. Bunnell, of the Pyrene Mfg. Co., Newark, N. J., who has resigned.

Legge to Head Farm Board

Alexander Legge, president of the International Harvester Co., has been appointed to head the newly created Federal Farm Board, which will administer farm relief loans from the $500,000,000 fund appropriated by Congress, it has been announced in Washington.

Seaman Elects Howell

George P. Howell, of the Seaman Body Corp., Milwaukee, has been elected president of the Milwaukee Association of Purchasing Agents, which is affiliated with the national association.

W. R. Carnegie is Named Head of Berry Brothers

W. R. Carnegie has been appointed president and general manager of the Berry Brothers Corp., assuming his new duties July 1. Mr. Carnegie was formerly vice-president and general manager of the concern.

John C. Witherspoon, for many years a member of the board of directors, has been appointed to the office of vice-president. The board has been increased by two members. They are H. L. Stanton, an attorney, with wide experience in corporation management, and Joseph Berry Sherrard, grandson of Joseph H. Berry, one of the founders.

The new president of Berry Brothers joined the organization in 1895. He was treasurer for 25 years before taking up his present duties as general manager.

Viriot to Live in Detroit

Charles Viriot, vice-president in charge of sales of the Repusseau Co., of Paris, arranged to sail for the United States on the steamer Paris, July 4. M. Miriot, who recently returned from America, will make his headquarters in Detroit. He intends to remain a year in this country. Recently M. Viriot announced that contracts had been signed for Repusseau Silenbloc rubber bushings to be used as standard equipment on four important American automobiles next year, and that other important business is in prospect.

Ferro Appoints Fairbanks

C. C. Fairbanks has been appointed sales manager of the Ferro Stamping & Mfg. Co., Detroit. Mr. Fairbanks has been affiliated with the automotive industry for the last 17 years and has been connected with Ferro for five years, as district sales representative at Cleveland and as sales engineer at the Detroit office.

Jewett Elected President

The Milwaukee Chapter of the American Society for Steel Treating, has elected M. G. Jewett of the Chain Belt Co. as president, and F. A. Hansen, of the Hevi-Duty Electric Co., as vice-president. Ray Thiessenhusen, of the Wesley Steel Treating Co., was reelected secretary and treasurer.

Kamerer Succeeds Mosher

F. D. Kamerer has been appointed auditor of disbursements by the General Electric Co. to succeed George F. Mosher, recently elected assistant treasurer, according to an announcement by S. L. Whitestone, comptroller.

Webster Leaves Durant

Daniel Webster, who has been associated with the purchasing department of Durant Motors Inc., for several years, has resigned.

Continental Motors Earned $582,000

Judson Reports Highest Rate of Operating Activity Since War

DETROIT, July 2—For the first half of the fiscal year ended April 30, Continental Motors Corp. reports net profit of $582,000. Commenting upon the situation, Ross W. Judson, president, said:

"The first half of the fiscal year was notable because it represented the highest rate of operating activity of the corporation since the war. This was largely due to the introduction of additional new models of motors, principally in the industrial division.

The activities of the corporation were not proportionally reflected in its operating profits, due to the increased expense of launching into production the new industrial and aviation motors. Orders and contracts on hand would indicate a satisfactory operation of the corporation's facilities."

According to the statement the corporation has current assets of $13,564,-010.37, of which $3,607,411.60 represents cash on hand; $1,502,934 in government and municipal securities; $25,522 in accrued interest receivable; $2,556,-076.55 in accounts receivable; $90,539.03 sundry debtors; $33,076.11 notes receivable; and $5,748,450.85 in inventories of raw and worked materials. The company has declared a quarterly dividend of 20 cents per share, payable July 30 to stock of record July 15. With this dividend, $1,197,369 will have been paid to stockholders in 1929.

Oakland Expects Saving of $1,000,000 in Its Cost

PONTIAC, MICH., July 6—As a result of its campaign against waste, recently started among workers, the Oakland Motor Car Co. will effect projected savings of approximately $1,000,000 annually, according to an announcement by Gordon Lefebvre, vice-president in charge of operations. More than $1,200 in prizes was offered plant workers for suggestions on cutting down time or material costs. The contest is to be extended indefinitely.

During the two weeks of the contest, 3558 plans were submitted by the 11,000 workers. Of the suggestions turned in, 35 per cent already evaluated will effect a projected saving of $542,000, Mr. Lefebvre said, while those still to be investigated are expected to effect a similar saving. The grand prize plan recommended a substitute fuel for gasoline for operating Oakland and Pontiac engines in tests before assembly on the finished car. This plan alone will result in a saving of $33,000 within a year, it was said.

S. K. F. Corp. to Offer Shares

DETROIT, July 2—An offering of "American" certificates, representing "B" shares of the S.K.F. Corporation, large Swedish roller bearing manufacturer, will be made soon by a group of New York bankers, it was reported in Wall Street today.

Tool Firms Plan Merger

MILWAUKEE, July 1—Negotiations are under way for the consolidation of the Blue Point Tool Co. and the Snap-On Wrench Co., both of this city, before the close of the year. It is planned to build a new plant and greatly enlarge the output of both divisions. The present payrolls number 250 and the force will be doubled, according to William Seideman, secretary and treasurer of the Snap-On company.

Young Spring and Wire to Decide on Cash Rate

DETROIT, June 29—Directors of the L. A. Young Spring & Wire Corp. will meet before July 15 and will declare a stock dividend, and make some change in the present cash rate, according to L. A. Young, president. Mr. Young said the company's earnings for the first half of the year will be around $4.60 a share, after all charges and taxes. The outlook for the third quarter is good and he sees no sign of any appreciable let-up.

The corporation earnings were at the rate of $3.80 per share for the first six months of last year.

Financial Notes

Borg-Warner Corp. has reported a net profit for the first five months of 1929 of $3,909,979, after all charges, including depreciation, interest, Federal taxes and minority interest, equal after preferred dividends to $5.12 a share on the 744,068 shares of common stock outstanding at the end of the period. No comparative figures are available, as there are now nine divisions represented in Borg-Warner corporation whereas a year ago there were only four.

Packard Motor Car Co. has entered into an exclusive contract with the Commercial Credit Co. for the financing of retail sales to Packard distributors and dealers, effective July 1. Packard has changed the fiscal year to correspond with the calendar year. Previously, the fiscal year ended Aug. 31. A report will be issued, however, for the fiscal year ending Aug. 31, 1929.

Motor Products Corp. has reported a net income of $932,474 for the first quarter, equal to $6.86 a share on the outstanding common stock. For the year 1928 the company reported a net income of $2,643,749. Earnings for the first six months of this year are equal to $9.10 a share, the preferred stock having been redeemed last month.

United Aircraft & Transport Corp. has offered three shares of common stock for each share of Class A and B stock of the Pacific Air Transport Co. United already controls Pacific Air Transport Co. through the ownership of 3290 shares of Class A of outstanding issue of 4500 and 370 shares of 500 outstanding Class B stock. This offer is effective until Aug. 1.

Chance Vought Corp., subsidiary of United Aircraft & Transport Corp., reports net sales for May of approximately $380,-000, a new high record. Sales for the first five months of the current year were $1,113,500.

Melling Forge Co. has declared an extra dividend of 40 cents a share in addition to the regular dividend of 20 cents per share, both payable July 6.

Eaton Axle & Spring Co. has declared its regular dividend of 75 cents payable Aug. 1 to stockholders of record July 15.

H. H. Franklin Mfg. Co. has declared its regular quarterly dividend of 50 cents.

Lakey Foundry & Machine Co. reports a net profit of $112,435.84 for the six months ended April 30, 1929. In a statement to stockholders, H. A. Becker, president, declares that this shows a temporary but substantial reduction in the earnings of the company which he attributes to a number of unforeseen and unfortunate factors which combined to interrupt production and increase expenses, with a resultant decrease in profits. The company has declared a quarterly dividend of 50 cents per share, and an extra 2½ per cent stock dividend payable April 30 to stock of record July 15.

Johns-Manville Corp. is forming a million-dollar holding corporation to control its foreign operations, with the exception of branches in Canada, according to announcement made by W. R. Seigle, chairman of the board.

The name of the new company, which is chartered in Delaware, is the Johns-Manville International Corp. It will hold all the stock owned by the home company in branches operating in Europe and South America. Some of those companies are owned outright and others in part.

Transport Aircraft Corp., Inc., recently formed to acquire the Kaess Mfg. Corp. of Lindenhurst, L. I., and owning 50 per cent of the common stock of Airplane & Marine Direction Finder, Inc., will float an issue of 40,000 shares no par value common stock for financing purposes. The authorized common stock consists of 200,000 shares, of which 100,000 shares will be outstanding.

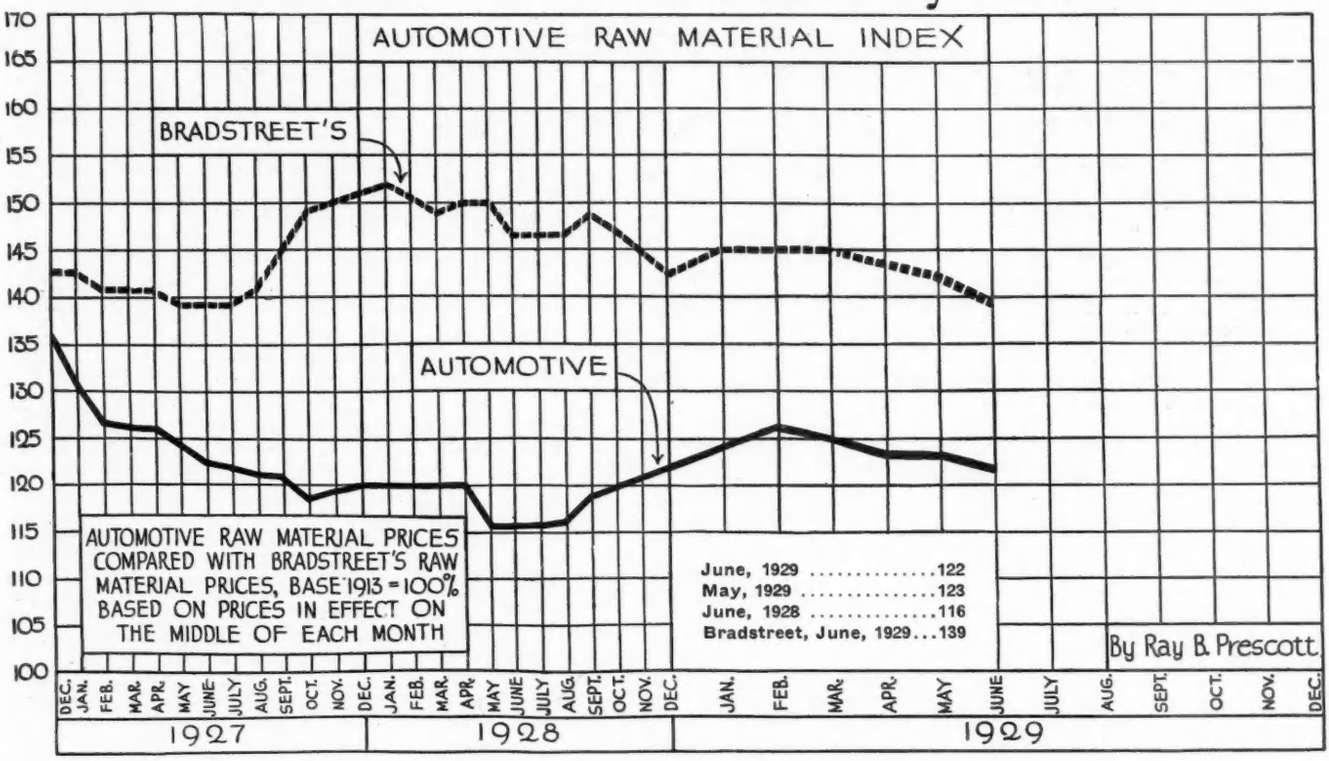
Brockway Motor Truck Corp. has authorized the sale of 25,000 shares of additional common stock at $50 a share, proceeds to be used for general corporate purposes. Directors will allocate $45 a share net proceeds from this issue to capital. Present stockholders have no preemptive right with respect to this additional flotation.

Fokker Aircraft Corp. of America has declared regular quarterly dividend of 47½ cents on first preferred payable July 15 to holders of record June 25.

American Car & Foundry Co. reports net earnings for the year ended April 30 of 2,715,174. This compares with earnings of $3,754,555 for the preceding year.

Frost Gear & Forge Co. has declared a dividend of 20 cents, payable July 15.

Raw Material Prices Decline by One Point



Mueller Organizes Firm to Make Hydraulic Jack

RACINE, WIS., July 2—As the outgrowth of the tool and die business established many years ago by Michael Mueller on the outskirts of Racine, Wis., the Mueller Engineering Works, Inc., of Racine, has been incorporated with $100,000 capital stock and is acquiring more than 12,000 sq. ft. of floor space in the Sattley Industrial group to engage in the quantity production of a recently perfected hydraulic jack.

Mr. Mueller is retiring from active business but the new enterprise will be conducted by his sons, J. J. Mueller and D. J. Mueller, and a son-in-law, Samuel Shilstad, who has been working with the inventor. Besides hydraulic jacks, the new concern will also manufacture other special devices, tools, etc.

Cirrus Engine in Flight

CLEVELAND, July 2—The first engine produced by American Cirrus Engines, Inc., has been tested in flight by the Great Lakes Aircraft Corp. of Cleveland, and its performance measured up to all expectations, according to Col. Benjamin F. Castle, president of the corporation. Great Lakes Aircraft is a subsidiary of Allied Motor Industries, Inc., Chicago, which acquired American Cirrus Engines recently.

To Build New British Racer

LONDON, June 29—According to a statement made recently by Louis Coatalen, chief engineer and a director of the Sunbeam Motor Co., the efforts which are said to be in prospect in the United States to regain the world's speed record, set at 231 m.p.h. by Sir Henry Segrave in the Golden Arrow, will be countered by the construction of a new British car.

A.A.A. Explains Ruling

WASHINGTON, July 3—The contest board of the American Automobile Association today issued a statement to the effect that racing cars of 91 cu. in. will continue in general use in races sanctioned by the association, although the Memorial Day race at Indianapolis will have its entries confined to the 366 cu. in. two-man cars without superchargers.

Truck Firm Changes Name

VANCOUVER, B. C., July 1—The name of the Hayes-Anderson Motor Co., Ltd., has been changed to the Hayes Mfg. Co., Ltd., according to an announcement by Douglas Hayes, secretary-treasurer of the new company. The manufacture of motor trucks, trailers, and industrial powerplants will be continued. The officers of the new company are: J. P. D. Malkin, president; Gordon Farrell, vice-president, and Douglas Hayes, secretary-treasurer.

Charles H. Doelger

MILWAUKEE, July 1—Charles H. Doelger, senior member of Doelger & Kirsten, Milwaukee, manufacturer of alligator shears and other tools for cutting steel plates and sheets, died June 25 after a year's illness. He founded the shear business in 1889 with Oscar F. Kirsten.

Monroe Auto Equipment Has New Shock Absorber

MONROE, MICH., July 2—After more than 18 months of research, experimental and test work, the Monroe Auto Equipment Co. has announced the perfection of a new two-way hydraulic shock absorber. Equipment contracts closed by the Monroe company will necessitate a marked increase in production and considerable expansion of the company's plants.

F. J. Thibault, chief engineer, and J. M. Nickelsen, of the University of Michigan, department of engineering, are credited with perfecting the details of the new accessory. It was also announced that the company would continue production of the one-way shock absorber which now is standard equipment on more than 1,000,000 cars, with a present production of 50,000 sets a month.

Motorcycles Show Gain

WASHINGTON July 3—World production of motorcycles during 1928 numbered 400,000 units, increasing by 22 per cent over the 1927 figure of 328,000, according to estimates made this week by the automotive division of the Department of Commerce.

To Spend $2,000,000 for Planes

WASHINGTON, July 3—The War Department this week announced approval of contracts for airplane engines to cost approximately $2,000,000. The contracts were divided between the Pratt-Whitney, Curtiss and Wright companies.

Exports, Imports and Reimports of the Automotive Industry for May of Current Year, and Total for Five Months Ending May, 1929

	Month of May				Five Months Ending May			
	1928		1929		1928		1929	
	Number	Value	Number	Value	Number	Value	Number	Value
Automobiles, parts and accessories	..	$46,650,107	..	$43,120,126	..	$204,828,875	..	$288,364,826
Electric trucks and passenger cars	26	22,368	14	27,867	71	86,020	44	57,495
Motor trucks and buses except electric (total)	9,061	6,388,809	11,496	8,016,500	47,284	33,418,640	85,912	51,004,768
Up to 1 ton inclusive	6,600	3,497,747	7,192	3,813,940	36,647	18,896,834	62,363	27,778,609
Over 1 and up to 2½ tons	2,119	2,308,442	4,055	3,453,996	9,802	11,175,521	22,022	19,199,437
Over 2½ tons	342	582,620	249	748,564	1,375	3,346,285	1,527	4,026,722
PASSENGER CARS								
Passenger cars, except electric (total)	38,851	28,217,696	28,417	20,269,753	158,274	115,692,059	185,504	128,697,318
Low price range up to $1,000	31,082	17,684,750	21,853	11,843,455	123,309	68,550,391	141,043	73,140,466
Medium price range over $1,000 to $2,000	6,584	7,557,916	5,666	6,231,544	29,869	34,431,947	39,149	42,837,107
High price range over $2,000	1,185	2,975,030	898	2,194,754	5,096	12,709,721	5,312	12,719,745
PARTS, ETC.								
Parts except engines and tires	..	..	..	..	..	..	..	..
Automobile unit assemblies	..	5,301,252	..	8,643,412	..	24,726,716	..	62,599,056
Automobile parts for replacement (n. e. s.)	..	4,179,162	..	3,986,717	..	20,293,151	..	33,969,161
Automobile accessories	..	827,178	..	814,663	..	3,736,022	..	4,849,885
Automobile service appliances (n. e. s.)	..	839,573	..	602,432	..	3,071,525	..	3,078,503
Trailers	85	26,642	54	41,468	292	130,646	377	200,166
Airplanes, seaplanes and other aircraft	17	210,288	49	794,024	79	832,559	146	2,435,070
Parts of airplanes except engines and tires	..	141,469	..	189,958	..	420,090	..	846,510
BICYCLES, ETC.								
Bicycles	512	13,233	206	5,973	2,198	58,512	2,188	59,334
Motorcycles	2,397	551,228	1,496	348,579	9,097	2,116,059	9,868	2,222,602
Parts, except tires	..	147,389	..	90,507	..	608,645	..	521,386
INTERNAL COMBUSTION ENGINES Stationary and Portable								
Diesel and Semi-Diesel	107	53,514	36	104,665	292	347,514	415	556,776
Other stationary and portable:								
Not over 10 hp.	3,642	316,854	3,260	277,997	15,007	1,297,870	16,945	1,491,930
Over 10 hp.	217	93,354	405	178,519	1,078	479,182	2,286	1,008,077
Automobile engines for motor trucks and buses	1,472	119,662	586	113,406	5,981	633,158	5,902	793,889
Passenger cars	16,912	1,593,980	12,351	1,189,411	69,320	6,243,109	59,546	6,104,582
Tractors	94	18,305	1	435	219	62,146	387	100,887
Aircraft	12	49,949	24	94,315	58	208,516	149	718,455
Accessories and parts (carburetors)	..	388,132	..	472,413	..	1,571,649	..	2,059,643
IMPORTS								
Automobiles and chassis (dutiable)	56	101,754	67	120,804	184	454,900	244	525,451
Other vehicles and parts for them (dutiable)	..	27,297	..	217,455	..	205,833	..	760,388
REIMPORTS								
Automobiles (free from duty)	32	31,657	63	67,106	122	123,798	225	270,276

Pheasant Aircraft Tries New Type 110 hp. Engine

MILWAUKEE, July 3—The Pheasant Aircraft Co., formerly of Memphis, Mo., but acquired recently by T. W. Meiklejohn and associates of Fond du Lac, Wis., is mounting a new production air-cooled engine made by the Dayton Airplane Engine Co., Dayton, Ohio, in an experimental plane as a final step in adopting it as standard equipment.

The new engine is rated at 110 hp. and weighs considerably less than the 90-hp. engine used heretofore. The similarity of the Dayton engine to the automobile type makes it easier to install and simpler to handle. The new type engine will increase the performance of the Pheasant plane to a cruising speed of 105 m.p.h. and a top speed of 120 m.p.h., according to R. H. Grant, president of the Dayton company, who is supervising the installation at the Fond du Lac plant.

Brill Explains Rumor

PHILADELPHIA, July 1—In response to an inquiry at the offices of the J. G. Brill Co., maker of cars and trucks, regarding a rumor that the company intended to produce Diesel type engines for use in rail cars, a high official of the company stated that at present the company was not convinced that Diesel engines had reached a point where they would be suitable for use in any types of equipment now manufactured by the company. He stated further that the company was not immediately in a position to produce Diesel engines, but that when the time came that the engines were believed suitable for use in rail equipment that the company would undoubtedly take advantage of the new development and produce them in the desired quantities.

Rail Services Arranged

WASHINGTON, July 3—The French Southern Railway recently created a subsidiary company for the development and handling of automobile services which will be operated in conjunction with the rail services of the line, according to a Paris report received this week by the Department of Commerce. The action of the French Southern follows similar action taken by the Northern Railway of France.

Herman Body to Add Unit

DECATUR, ILL., July 1—The Herman Body Co. of St. Louis, manufacturer of specially built truck bodies and wholesale distributor for the York-Hoover truck bodies, is preparing to establish a branch assembly plant here, according to Herman E. Plew, president.

Correction

The Sterling Motor Truck Co. of Milwaukee, Wis., is not owned by Allied Motors, Inc., as was indicated through an error in a story appearing in the June 8 issue of *Automotive Industries*. The ownership of the company has been in the hands of the same group for 20 years.

Waukesha Predicts Gain of 90 Per Cent for Year

MILWAUKEE, July 2—With production of engines averaging 8000 a month during the last six months, and orders being booked at a rate that is expected to maintain this schedule for some months to come, the Waukesha Motor Co., Waukesha, Wis., probably will show a 90 per cent increase over the preceding year for the fiscal year ending July 31, according to H. L. Horning, president and chief engineer.

The company is now in production on 300 hp. industrial units and powerful rail engines. A decision is expected some time in July as to the proposed entrance into the aviation engine field. Mr. Horning has recently returned from an extensive western trip, during which he investigated aircraft engine prospects.

Storm Halts Roosevelt Run

INDIANAPOLIS, July 1 — The Roosevelt endurance tests, which had been in progress on the Indianapolis Motor Speedway for more than two weeks, were brought to a halt last night by the heavy wind and rain. The first car, which was put into motion June 12, had been traveling continuously for 440 hours, 31 minutes, while the second had been operated for 391 hours, 36 minutes. The average speed of the cars was 35 m.p.h., but the number of miles traveled was not determined. The wind was so strong that it blew portions of the grandstand into the paths of the cars and demolished the crew headquarters.

Opposition Found to Tariff Abroad

UTICA, N. Y., July 2—G. L. Brunner, treasurer and general manager of the Brunner Mfg. Co., maker of air compressors, stated today that during a three months' business trip through Europe, just completed, he found widespread manifestations of adverse sentiment to the tariff bill now before Congress. Mr. Brunner declared that, as a result of these observations he, as an American exporter, was decidedly opposed to the tariff measure.

"I believe in a protective tariff for industries where this tariff is necessary and particularly where the industry cannot exist without such protection," Mr. Brunner said. "On the other hand, I believe it is short-sighted policy to build a tariff wall around America so that it is impossible for other countries to do business here.

"When I was in Switzerland, early in May, meetings were being held by the larger industrial concerns who are the largest consumers of American trucks, with a view of a boycott against American products of all kinds, but American trucks in particular. In France 500 chambers of commerce were holding meetings of protest and looking for means of definite adverse action against all American products. Similar hostility to a greater or less degree was manifest in conversations I had with many business men in Great Britain, Spain, Italy, Germany, Holland and Belgium."

Makes 19,004,273 Rings

HAGERSTOWN, IND., July 1—The Perfect Circle Co., of this city produced a total of 19,004,273 piston rings during the first five months of 1929, according to Lothair Teetor, vice-president in charge of sales. This is an increase of 17 per cent over the corresponding period last year.

Automotive Exports Gaining on Cotton

WASHINGTON, July 3—The automobile is threatening the supremacy of cotton in American export trade, according to an analysis of world trade announced this week by the Department of Commerce. During the first quarter of the year automotive exports constituted 13 per cent of the total as against 14.9 for unmanufactured cotton, a record for automotive exports and the lowest percentage in recent years for cotton.

Ohio Seamless to Build

DETROIT, July 2—The Ohio Seamless Tube Co. of Shelby, Ohio, has approved plans for an increase of 40 per cent in plant capacity. The expansion program is the result of increased demand from the automobile and aviation industries. About $400,000 will be spent on new buildings and additional equipment.

Robert W. Reed

MILWAUKEE, June 29—Robert W. Reed, secretary of the Mullins Body & Tank Co., Milwaukee, manufacturer of motor truck and other equipment, died June 18, after a brief illness. Mr. Reed, who was 40 years old, was the son of William J. Reed, president and treasurer of the Reed-Waite Co., Milwaukee, manufacturing automotive equipment.

Globe Machinery Opens Plant

DES MOINES, IOWA, July 2—The Globe Machinery & Supply Co., of this city, maker of automobile hoists, has opened its new $100,000 plant, a one-story brick structure with approximately 20,000 sq. ft. of floor space.

Autocar Explains Merger Committee

PHILADELPHIA, July 1—A press statement that R. P. Page, Jr., president of the Autocar Co., Ardmore, Pa., has appointed a committee of directors of the company to study the advisability of a merger with interests representing the Brockway Motor Truck Co., was confirmed at the offices of the Autocar Co. today.

At the same time it was stated on excellent authority that a condition of any possible merger would be retention of the Autocar name and corporate identity, and that no merger would be considered under any other conditions. Beyond the appointment of the committee as announced above, no overtures toward merger have originated with the Autocar Co.

Rumors that Brockway affiliations have acquired large blocks of stock from Autocar holders were stated to be partly true in that a few options have been issued for the sale of stock in the Autocar Co.

Ford to Enlarge Plant

INDIANAPOLIS, IND., July 1—The contract for enlarging and remodeling the body assembly branch of the Ford Motor Co. at Cleveland, Ohio, has been awarded to the Krebay Construction Co. of Indianapolis, according to an announcement made here by the Chamber of Commerce. Local advices state that about $250,000 will be expended in the construction program at the plant.

Goodyear Offering Rebate

DETROIT, June 29—Goodyear Tire & Rubber Co. is offering its dealers a 2½ per cent rebate, payable in merchandise credit, on all passenger car casings and tubes purchased between May 1 and Oct. 31, 1929. The rebate does not affect the present retail prices to the public.

Calendar of Coming Events

SHOWS

International Aircraft Exhibition, Olympia, London .....July 16-27
International Aircraft Exhibit, Coliseum, Chicago .....Sept. 7-15
National Machine Tool Builders' Exposition and Congress, Cleveland, Sept. 30-Oct. 4
Paris, Automobiles .....Oct. 3-13
London, Automobiles .....Oct. 17-26
Prague, Automobiles .....Oct. 23-30
Paris, Motorcycles .....Oct. 23-Nov. 3
M.&A.E. Show and Convention, Chicago .....Nov. 4-9
N.S.P.A. Show and Convention, Detroit .....Nov. 11-16
Berlin Auto Salon .....Nov. 14
London, Trucks .....Nov. 7-16
Paris, Trucks .....Nov. 14-24
London, Motorcycles .....Nov. 30-Dec. 7
Brussels Auto Salon.....Dec. 7
New York National.....Jan. 4-11
Chicago National, Coliseum..Jan. 25-Feb. 1

CONVENTIONS

International Chamber of Commerce, Fifth Congress, Amsterdam...July 8-13
National Association of Show and Association Managers, Meeting, Chicago .....July 25-26
Second Pan-American Congress of Highways, Rio de Janeiro.....Aug. 16-31
American Welding Society, Fall Meeting and Exposition, Cleveland....Sept. 9-12
American Institute of Mining and Metallurgical Engineers, Cleveland, Sept. 9-12
American Society for Steel Treating, Convention and Exposition, Cleveland .....Sept. 9-13
American Chemical Society, Fall Meeting, Minneapolis .....Sept. 9-13
A.S.M.E.—Iron and Steel Division—National Meeting, Cleveland...Sept. 11-13
Society for Electrical Development, New York City .....Sept. 13
Eastern States Exposition, Springfield, Mass. .....Sept. 15-21
American Electric Railway Association, Atlantic City .....Sept. 28-Oct. 4
National Safety Congress, Annual, Chicago .....Sept. 30-Oct. 4
Penna. Automotive Association, Erie, Pa. .....Oct. 7-8
Permanent International Association of Road Congresses, Sixth Session, Washington, D. C.....Oct. 7-11
Society of Industrial Engineers, Detroit .....Oct. 16-18
National Hardware Association, Atlantic City .....Oct. 21-24
World Engineering Congress, Tokio, Japan .....Oct. 29-Nov. 22
National Automobile Dealers Association, New York City .....Jan. 6
National Automotive Dealers Association, Chicago .....Jan. 27-28

RACES

Spanish Grand Prix .....July 31
British Tourist Trophy Race.....Aug. 17
Akron .....Aug. 18
National Air Races and Show, Cleveland, Aug. 24-Sept. 2
European Grand Prix, Italy.....Sept. 8
Syracuse .....Aug. 31
Altoona, Pa. .....Sept. 2
Cleveland .....Sept. 15

S. A. E.

Aeronautic Meeting, Cleveland..Aug. 26-28
Production Meeting, Cleveland.....Oct. 2-4
Annual Meeting, Detroit.....Jan. 21-24

SALONS

Hotel Drake, Chicago .....Nov. 9-16
Hotel Commodore, New York City..Dec. 1-7
Hotel Biltmore, Los Angeles.....Feb. 8-15
Palace Hotel, San Francisco, Feb. 22-Mar. 1